IMS

Utilities Reference: System

Version 9

SC18-7834-00

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Note:
Before using this information and the product it supports, be sure to read the general information under “Notices” on page 607.

First Edition (October 2004)

This edition applies to Version 9 of IMS (product number 5655–J38) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About This Book

This information is available as part of the DB2® Information Management Software Information Center for z/OS® Solutions to view the information within the DB2 Information Management Software Information Center for z/OS Solutions, go to http://publib.boulder.ibm.com/infocenter/dzichelp. This information is also available in PDF and BookManager® formats. To get the most current versions of the PDF and BookManager formats, go to the IMS™ Library page at www.ibm.com/software/data/ims/library.html.

This book is a reference manual for database administrators and system programmers who use the IMS utilities common to the IMS Database Manager (IMS DB) and IMS Transaction Manager (IMS TM) to administer the IMS system.

This book is one of two utilities references in the IMS library. The scope of the publications is as follows:

- *IMS Version 9: Utilities Reference: System* describes utilities that apply to IMS at a system level or that affect both database and data communications operations.
- *IMS Version 9: Utilities Reference: Database and Transaction Manager* describes utilities that affect database operations and data communications.

With IMS Version 9, you can reorganize HALDB partitions online, either by using the integrated HALDB Online Reorganization function or by using an external product. In this information, the term *HALDB Online Reorganization* refers to the integrated HALDB Online Reorganization function that is part of IMS Version 9, unless otherwise indicated.

IMS Version 9 provides an integrated IMS Connect function, which offers a functional replacement for the IMS Connect tool (program number 5655–K52). In this information, the term *IMS Connect* refers to the integrated IMS Connect function that is part of IMS Version 9, unless otherwise indicated.

Organization of This Book

This book has seven parts:

- Part 1, “Generation Utilities” contains information on the generation utilities for DBDs, PSBs, and ACBs.
- Part 2, “Service Utilities” describes the service utilities for dynamic allocation, security maintenance, and online change.
- Part 3, “Log Utilities” has information on the utilities used for archiving, merging, and recovering logs.
- Part 4, “Analysis Utilities and Reports” discusses the utilities used to generate and print IMS reports.
- Part 5, “Interpreting IMS Reports” explains how to interpret IMS reports.
- Part 6, “Knowledge-Based Log Analysis” discusses Knowledge-Based Log Analysis.
- Part 7. Appendixes contains the Bibliography and the Index.

For a complete list of all books cited in this manual see the “Bibliography” on page 611.

Prerequisite Knowledge

IBM® offers a wide variety of classroom and self-study courses to help you learn IMS. For a complete list of courses, see the IMS Web site at www.ibm.com/ims.

The reader should be familiar with z/OS, and with IMS concepts, facilities, and access methods. The prerequisite publications are:

- *IMS Version 9: Release Planning Guide*
- *IMS Version 9: Administration Guide: System*
- *IMS Version 9: Administration Guide: Database Manager*
- *IMS Version 9: Administration Guide: Transaction Manager*

Organization of Utility Descriptions

Utility descriptions are generally organized the same way, to help you find information easily. Most utilities are described this way:

- Overview of the utility's functions
- Restrictions that apply to the utility, such as processing that cannot be done concurrently with the utility
- Input and output
- Job control statements needed to run the job
- Utility control statements used to specify various processing options.

When applicable, the descriptions also include:

- Output messages and statistics reports produced by the utility
- Error processing, with return codes and their meanings
- Examples of how to use the utility.

CICS, DBCTL, and DCCTL

When running CICS® with DBCTL, CICS 3.1 or later releases must be used.

For DBCTL users, all utilities, commands, and parameters that are valid for IMS/DB are valid for DBCTL, unless otherwise noted.

For DCCTL users, all utilities, commands, and parameters that are valid for IMS/TM are valid for DCCTL, unless otherwise noted.

IBM Product Names Used in This Information

In this information, the licensed programs shown in Table 1 are referred to by their short names.

Table 1. Licensed Program Full Names and Short Names

Licensed program full name	Licensed program short name
IBM Application Recovery Tool for IMS and DB2	Application Recovery Tool
IBM CICS Transaction Server for OS/390®	CICS
IBM CICS Transaction Server for z/OS	CICS
IBM DB2 Universal Database™	DB2 Universal Database
IBM DB2 Universal Database for z/OS	DB2 UDB for z/OS

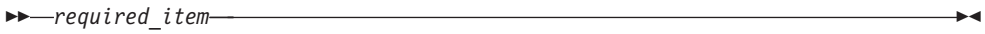
Table 1. Licensed Program Full Names and Short Names (continued)

Licensed program full name	Licensed program short name
IBM Enterprise COBOL for z/OS and OS/390	Enterprise COBOL
IBM Enterprise PL/I for z/OS and OS/390	Enterprise PL/I
IBM High Level Assembler for MVS™ & VM & VSE	High Level Assembler
IBM IMS Advanced ACB Generator	IMS Advanced ACB Generator
IBM IMS Batch Backout Manager	IMS Batch Backout Manager
IBM IMS Batch Terminal Simulator	IMS Batch Terminal Simulator
IBM IMS Buffer Pool Analyzer	IMS Buffer Pool Analyzer
IBM IMS Command Control Facility for z/OS	IMS Command Control Facility
IBM IMS Connect for z/OS	IMS Connect
IBM IMS Connector for Java™	IMS Connector for Java
IBM IMS Database Control Suite	IMS Database Control Suite
IBM IMS Database Recovery Facility for z/OS	IMS Database Recovery Facility
IBM IMS Database Repair Facility	IMS Database Repair Facility
IBM IMS DataPropagator™ for z/OS	IMS DataPropagator
IBM IMS DEDB Fast Recovery	IMS DEDB Fast Recovery
IBM IMS Extended Terminal Option Support	IMS ETO Support
IBM IMS Fast Path Basic Tools	IMS Fast Path Basic Tools
IBM IMS Fast Path Online Tools	IMS Fast Path Online Tools
IBM IMS Hardware Data Compression-Extended	IMS Hardware Data Compression-Extended
IBM IMS High Availability Large Database (HALDB) Conversion Aid for z/OS	IBM IMS HALDB Conversion Aid
IBM IMS High Performance Change Accumulation Utility for z/OS	IMS High Performance Change Accumulation Utility
IBM IMS High Performance Load for z/OS	IMS HP Load
IBM IMS High Performance Pointer Checker for OS/390	IMS HP Pointer Checker
IBM IMS High Performance Prefix Resolution for z/OS	IMS HP Prefix Resolution
IBM Tivoli® NetView® for z/OS	Tivoli NetView for z/OS
IBM WebSphere® Application Server for z/OS and OS/390	WebSphere Application Server for z/OS
IBM WebSphere MQ for z/OS	WebSphere MQ
IBM WebSphere Studio Application Developer Integration Edition	WebSphere Studio
IBM z/OS	z/OS

How to Read Syntax Diagrams

The following rules apply to the syntax diagrams that are used in this information:

- Read the syntax diagrams from left to right, from top to bottom, following the path of the line. The following conventions are used:
  - The >>--- symbol indicates the beginning of a syntax diagram.
  - The ---> symbol indicates that the syntax diagram is continued on the next line.
  - The >--- symbol indicates that a syntax diagram is continued from the previous line.
  - The --->< symbol indicates the end of a syntax diagram.
- Required items appear on the horizontal line (the main path).

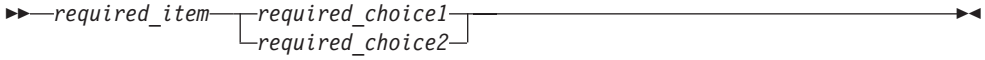


- Optional items appear below the main path.

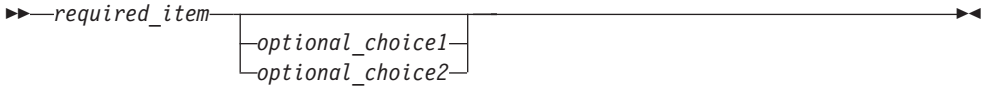
  If an optional item appears above the main path, that item has no effect on the execution of the syntax element and is used only for readability.

- If you can choose from two or more items, they appear vertically, in a stack.

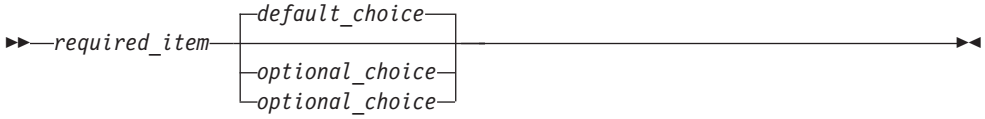
  If you *must* choose one of the items, one item of the stack appears on the main path.



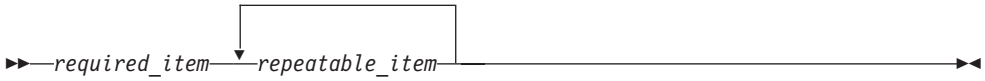
  If choosing one of the items is optional, the entire stack appears below the main path.



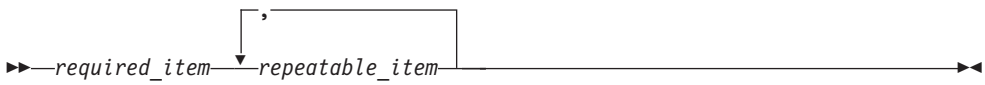
  If one of the items is the default, it appears above the main path, and the remaining choices are shown below.



- An arrow returning to the left, above the main line, indicates an item that can be repeated.



If the repeat arrow contains a comma, you must separate repeated items with a comma.



A repeat arrow above a stack indicates that you can repeat the items in the stack.

- Sometimes a diagram must be split into fragments. The syntax fragment is shown separately from the main syntax diagram, but the contents of the fragment should be read as if they are on the main path of the diagram.

fragment-name:

- In IMS, a b symbol indicates one blank position.
- Keywords, and their minimum abbreviations if applicable, appear in uppercase. They must be spelled exactly as shown. Variables appear in all lowercase italic letters (for example, *column-name*). They represent user-supplied names or values.
- Separate keywords and parameters by at least one space if no intervening punctuation is shown in the diagram.
- Enter punctuation marks, parentheses, arithmetic operators, and other symbols, exactly as shown in the diagram.
- Footnotes are shown by a number in parentheses, for example (1).

How to Send Your Comments

Your feedback is important in helping us provide the most accurate and highest quality information. If you have any comments about this or any other IMS information, you can take one of the following actions:

- Go to the IMS Library page at www.ibm.com/software/data/ims/library.html and click the Library Feedback link, where you can enter and submit comments.
- Send your comments by e-mail to imspubs@us.ibm.com. Be sure to include the title, the part number of the title, the version of IMS, and, if applicable, the specific location of the text on which you are commenting (for example, a page number in the PDF or a heading in the Information Center).

Summary of Changes

Changes to This Book for IMS Version 9

This book contains new technical information for IMS Version 9, changed technical information, and editorial changes.

New information about the following technical enhancements is included:

- HALDB Online Reorganization Support:

  "HDAM and PHDAM DBD Generation" on page 6

  "HIDAM and PHIDAM DBD Generation" on page 7
- RACF Enhancement to Replace SMU: Chapter 6, "Security Maintenance Utility (DFSISMP0)," on page 215
- IMS Availability Enhancements: Chapter 8, "Dynamic SVC Utility (DFSUSVC0)," on page 245
- DBRC Enhancements: "OLDS Recovery" on page 268.
- Knowledge-Based Log Analysis: Part 6, "Knowledge-Based Log Analysis," on page 501

The following information has changed significantly:

- Support for IEBCOPY parameters: "Online Change Copy Utility (DFSUOCU0)" on page 231

The following organizational changes have been made to this information:

- Chapter 4, "DLIModel Utility," on page 167, including information on XML support, has been added to Part 1, "Generation Utilities." This information was formerly described in *IMS Version 9: IMS Java Guide and Reference*.

For detailed information about technical enhancements for IMS Version 9, see the *IMS Version 9: Release Planning Guide*.

Library Changes for IMS Version 9

Changes to the IMS Library for IMS Version 9 include the addition of one title, a change of one title, organizational changes, and a major terminology change. Changes are indicated by a vertical bar (|) to the left of the changed text.

The IMS Version 9 information is now available in the DB2 Information Management Software Information Center for z/OS Solutions, which is available at http://publib.boulder.ibm.com/infocenter/dzichelp. The DB2 Information Management Software Information Center for z/OS Solutions provides a graphical user interface for centralized access to the product information for IMS, IMS Tools, DB2 Universal Database (UDB) for z/OS, DB2 Tools, and DB2 Query Management Facility (QMF™).

New and Revised Titles

The following list details the major changes to the IMS Version 9 library:

- *IMS Version 9: IMS Connect Guide and Reference*

  The library includes new information: *IMS Version 9: IMS Connect Guide and Reference*. This information is available in softcopy format only, as part of the DB2 Information Management Software Information Center for z/OS Solutions, and in PDF and BookManager formats.

IMS Version 9 provides an integrated IMS Connect function, which offers a functional replacement for the IMS Connect tool (program number 5655-K52). In this information, the term *IMS Connect* refers to the integrated IMS Connect function that is part of IMS Version 9, unless otherwise indicated.

- The information formerly titled *IMS Version 8: IMS Java User's Guide* is now titled *IMS Version 9: IMS Java Guide and Reference*. This information is available in softcopy format only, as part of the DB2 Information Management Software Information Center for z/OS Solutions, and in PDF and BookManager formats.
- To complement the IMS Version 9 library, a new book, *An Introduction to IMS* by Dean H. Meltz, Rick Long, Mark Harrington, Robert Hain, and Geoff Nicholls (ISBN # 0-13-185671-5), is available starting February 2005 from IBM Press. Go to the IMS Web site at www.ibm.com/ims for details.

Organizational Changes

Organization changes to the IMS Version 9 library include changes to:

- *IMS Version 9: IMS Java Guide and Reference*
- *IMS Version 9: Messages and Codes, Volume 1*
- *IMS Version 9: Utilities Reference: System*

The chapter titled ″DLIModel Utility″ has moved from *IMS Version 9: IMS Java Guide and Reference* to *IMS Version 9: Utilities Reference: System*.

The DLIModel utility messages that were in *IMS Version 9: IMS Java Guide and Reference* have moved to *IMS Version 9: Messages and Codes, Volume 1*.

Terminology Changes

IMS Version 9 introduces new terminology for IMS commands:

type-1 command
A command, generally preceded by a leading slash character, that can be entered from any valid IMS command source. In IMS Version 8, these commands were called *classic* commands.

type-2 command
A command that is entered only through the OM API. Type-2 commands are more flexible than type-2 commands and can have a broader scope. In IMS Version 8, these commands were called *IMSplex* commands or *enhanced* commands.

Accessibility Enhancements

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products. The major accessibility features in z/OS products, including IMS, enable users to:

- Use assistive technologies such as screen readers and screen magnifier software
- Operate specific or equivalent features using only the keyboard
- Customize display attributes such as color, contrast, and font size

User Assistive Technologies

Assistive technology products, such as screen readers, function with the IMS user interfaces. Consult the documentation of the assistive technology products for specific information when you use assistive technology to access these interfaces.

Accessible Information

Online information for IMS Version 9 is available in BookManager format, which is an accessible format. All BookManager functions can be accessed by using a keyboard or keyboard shortcut keys. BookManager also allows you to use screen readers and other assistive technologies. The BookManager READ/MVS product is included with the z/OS base product, and the BookManager Softcopy Reader (for workstations) is available on the IMS Licensed Product Kit (CD), which you can download from the Web at www.ibm.com.

Keyboard Navigation of the User Interface

Users can access IMS user interfaces using TSO/E or ISPF. Refer to the *z/OS V1R1.0 TSO/E Primer*, the *z/OS V1R5.0 TSO/E User's Guide*, and the *z/OS V1R5.0 ISPF User's Guide, Volume 1*. These guides describe how to navigate each interface, including the use of keyboard shortcuts or function keys (PF keys). Each guide includes the default settings for the PF keys and explains how to modify their functions.

Part 1. Generation Utilities

Chapter 1. Database Description (DBD) Generation

Use the Database Description Generation (DBDGEN) utility to define a database so it can be used by an application program. You create a Database Description (DBD) by coding special macro instructions. These macros become the input to the DBDGEN utility. Use DBDGEN for the following types of databases:

- HSAM (including SHSAM)
- GSAM
- HISAM (including SHISAM)
- HDAM
- PHDAM
- HIDAM
- PHIDAM
- MSDB
- DEDB
- Index
- PSINDEX
- Logical

There are strict rules for structuring DBDGEN input. A separate input set is required for each database.

The DBDGEN program accepts several types of control statements. Each control statement type is briefly described as follows:

- The DBD statement names the database being described and provides DL/I with information concerning database organization.
- The DATASET statement is used only in non-DEDB DBDGEN input record structures. The DATASET statement defines a data set group within a database. One or more DATASET statements follow the DBD statement.
- The AREA statement is used only in DEDB DBDGEN input record structures. The AREA statement defines an area within a database. One or more AREA statements follow the DBD statement.
- The SEGM statement defines the specified database's segments. The SEGM statement is used with the following statements:
  - FIELD
  - XDFLD
  - LCHILD

  Each statement defines different aspects of a segment.
- The DBDGEN statement indicates the end of DBDGEN control statements.
- FINISH is an optional statement retained in the input stream for compatibility.
- The END statement indicates to the z/OS assembler that the end of the input statements has been reached.

Related Reading: For more information on High Availability Large Databases, see *IMS Version 9: Administration Guide: Database Manager*.

The following topics provide additional information:

- "Information Specified in DBD Generation" on page 4
- "DBD Generation for Database Types" on page 4

Information Specified in DBD Generation

A database description (DBD) is a DL/I control block containing all of the database information needed by an application program. You can use only one physical DBD to describe each physical database; otherwise, user abend U850 or U853 occurs. At execution time, DL/I uses the DBD to create a set of internal control blocks. The DBDGEN utility defines each DBD with the following database information:

- Segment types
- Physical and logical relationships between segment types
- Database organization and access method
- Physical characteristics of the database

You can also use the DBDGEN utility to define the name and data options of selected exit routines.

DBD Generation for Database Types

The following databases use DBDGEN:

- HSAM (including SHSAM)
- GSAM
- HISAM (including SHISAM)
- HDAM
- PHDAM
- HIDAM
- PHIDAM

SHSAM and SHISAM are simple databases. Each contains only one fixed-length segment type. Discussions on SHSAM and SHISAM can be found in paragraphs dealing with HSAM and HISAM, respectively.

The following also use DBDGEN:

- MSDB
- DEDB
- Index
  - Primary HIDAM
  - Secondary
- PSINDEX
- Logical

HSAM DBD Generation

During DBD generation for an HSAM database, you specify:

- One data set group.
- The ddname of an input data set that is used when an application retrieves data from the database.

- The ddname of an output data set that is used when loading the database.
- From 1 to 255 segment types for the database.
- From 0 to 255 fields within each segment type, with a maximum of 1000 fields within the database.
- Optionally, you can define a simple HSAM (SHSAM) database that can contain only one fixed-length segment type. When defined, no prefixes are built in occurrences of the segment type.

For a HSAM database you cannot specify:

- The use of hierarchic or physical child/physical twin pointers between segments in the database
- The use of logical or index relationships between segments

GSAM DBD Generation

During DBD generation for a GSAM database, you specify:

- One data set group
- The ddname of an input data set that is used when an application retrieves data from the database
- The ddname of an output data set that is used when loading the database

You cannot specify:

- SEGM and FIELD statements
- The use of logical or index relationships between segments

IMS adds 2 bytes to the record length value specified in the DBD in order to accommodate the ZZ field that is needed to make up the BSAM RDW. Whenever the database is GSAM/BSAM and the records are variable (V or VB), IMS adds 2 bytes. The record size of the GSAM database is 2 bytes greater than the longest segment that is passed to IMS by the application program.

HISAM DBD Generation

During DBD generation for a HISAM database, you specify:

- One data set group.
- The ddname of one VSAM key sequenced data set (KSDS) and one VSAM entry sequenced data set (ESDS). HISAM supports only one data set group; you cannot have a secondary data set group with HISAM databases.
- Optionally, you can define a simple HISAM (SHISAM) database that can contain only one fixed-length segment type. When defined, no prefixes are built in occurrences of the segment type. The logical record length specified for a SHISAM database must be equal to or greater than the segment length specified.
- At least one segment type and a maximum of 255 segment types for the database.
- From 0 to 255 fields for each segment type, and a maximum of 1000 for the database, one of which must be a unique sequence field in the root segment type for indexing root segment occurrences.
- A maximum of 32 secondary index relationships (optional) per segment type, and a maximum of 1000 for the database.

- Logical relationships (optional) using symbolic pointer options when a segment in a HISAM database points to another segment in a HISAM database, and direct or symbolic pointer options when a segment in a HISAM database points to a segment in an HDAM or HIDAM database.
- Segment Edit/Compression exit routine routines, which are optional, to enable user-supplied routines to manipulate each occurrence of a segment type to or from auxiliary storage.
- Data Capture exit routine, which is optional, to enable DB2™ end users access to updated IMS data. This exit routine can be used in SHISAM also.

Restriction: You cannot specify the use of hierarchic or physical child/physical twin pointers between segments in a HISAM database.

HDAM and PHDAM DBD Generation

During DBD generation for HDAM and PHDAM databases, you specify:

- The name of the user-supplied randomizing module used for placement of root segment occurrences
- One to 10 data set groups
- How free space is to be distributed in each data set group
- The ddname of an OSAM or ESDS data set for each data set group defined (HDAM databases only)
- At least one segment type for each data set group, and a maximum of 255 segment types for the database
- Segment Edit/Compression exit routine routines, which are optional, to enable user-supplied routines to manipulate each occurrence of a segment type on their way to or from auxiliary storage
- The use of hierarchic or physical child/physical twin pointers between segments in the database
- Logical relationships (optional) between segments using direct address or symbolic pointer options
- From 0 to 255 fields for each segment type, and a maximum of 1000 for the database
- A maximum of 32 secondary index relationships (optional) per segment type and a maximum of 1000 for the database
- Data Capture exit routine, which is optional, to enable DB2 end users access to updated IMS data

Restrictions of DBDGEN for PHDAM

- The ddnames and data sets are not part of DBDGEN for PHDAM databases. The remaining database definition is purely for defining the hierarchical structure and relationships of the data.
- DBDGEN does not define each individual partition. For more information on defining partitions, see the *IMS Version 9: Administration Guide: Database Manager*.

Related Reading: See the information on tuning databases in *IMS Version 9: Administration Guide: Database Manager* for more information on online reorganization for PHDAM and PHIDAM databases.

HIDAM and PHIDAM DBD Generation

During DBD generation for HIDAM and PHIDAM databases, you specify:

- One to 10 data set groups
- How free space is to be distributed in each data set group
- The ddname of an OSAM or ESDS data set for each data set group defined (HDAM databases only)
- At least one segment type for each data set group, and a maximum of 255 segment types for the database
- Segment Edit/Compression exit routine routines, which are optional, to enable user-supplied routines to manipulate each occurrence of a segment type on their way to or from auxiliary storage
- A maximum of 32 secondary index relationships (optional) per segment type and a maximum of 1000 for the database
- The use of hierarchic or physical child/physical twin pointers between segments in the database
- Logical relationships (optional) between segments using direct address or symbolic pointer options
- From 0 to 255 fields for each segment type, and a maximum of 1000 for the database, one of which must be a unique sequence field in the root segment type for indexing root segment occurrences
- Data Capture exit routine, which is optional, to enable DB2 end users access to updated IMS data

DBDGEN for PHIDAM:

- The ddnames and data sets are not part of DBDGEN for PHIDAM databases. The remaining database definition is purely for defining the hierarchical structure and relationships of the data.
- DBDGEN does not define each individual partition. For more information on defining partitions, see the *IMS Version 9: Administration Guide: Database Manager*.

Related Reading: See the information on tuning databases in *IMS Version 9: Administration Guide: Database Manager* for more information on online reorganization for PHDAM and PHIDAM databases.

MSDB DBD Generation

During DBD generation for a MSDB, you must specify:

- One database name
- One data set group
- One segment type for the database
- From 0 to 255 fields within the database

You cannot specify:

- A logical or index relationship between segments
- Fields used with secondary indexes

If the DBD for an existing MSDB is changed, the header information (BHDR) might change, even though the database segments are unchanged. This might result in message DFS2593I because of the attempted load from the MSDBCPx data set. In

this case, the headers in the MSDBCPn data sets are either invalid or the wrong length. If ABND=y is specified in the MSDB PROCLIB member, it also causes a U1012 abend. After modifying the DBD, load the MSDBs from a MSDBINIT data set by using the MSDBLOAD option for either a warm start or a cold start to eliminate these problems.

DEDB DBD Generation

During DBD generation for a DEDB, you must specify:

- One database name
- From 1 to 2048 areas within a database
- From 1 to 127 segment types for the database
- From 0 to 255 fields for each segment type, with a maximum of 1000 fields within the database, one of which must be a unique sequence field for the root segment type
- The ddname or area name used to describe an area
- Data Capture exit routine, which is optional, to enable DB2 end users access to updated IMS data

You can optionally specify up to eight subset pointers for each child type of the parent.

You cannot specify:

- A logical or index relationship between segment types
- Fields used with secondary indexes

Index and PSINDEX DBD Generation

Primary HIDAM index DBD generation creates an index database composed of one index segment type that indexes occurrences of the HIDAM root segment type. PHIDAM does not have a DBD for the prime index. An index segment contains:

- The sequence field key of the root segment occurrence it indexes
- In its prefix, a direct address pointer to the root segment occurrence

During DBD generation for a primary HIDAM index, you must specify:

- One database name.
- One data set group. You must specify the ddname of one KSDS.
- One segment type.
- The index relationship required between the primary HIDAM index database and the root segment type of a HIDAM database.
- One field within the segment type as a sequence field.

Restrictions:

- You cannot specify any additional FIELD statements as you might for a secondary index.
- You cannot use DBDGEN to define individual partitions. For more information on defining partitions, see *IMS Version 9: Administration Guide: Database Manager*.
- Nonunique secondary index (PSINDEX) databases are not supported for HALDB.

Secondary index DBD generation creates a secondary index database made up of 1 to 16 index pointer segment types. These are used to index target segment types in HISAM, HDAM, PHDAM, HIDAM, or PHIDAM databases.

During DBD generation for a secondary index, you must specify:

- One database name.
- One data set group. If all index pointer segment keys are unique, you must specify the ddname of one KSDS. If index pointer segment keys are non-unique you must specify the ddnames of one KSDS and one ESDS. A secondary index must use VSAM.
- From 1 to 16 segment types.
- From 1 to 16 secondary index relationships.
- From 1 to 1000 fields for each segment type.

Logical DBD Generation

A logical DBD generation creates a logical database made up of logical segment types. A logical segment type is a segment type defined in a logical database that represents a segment type or the concatenation of two segment types defined in a physical database or databases.

During DBD generation for a logical database, you must specify:

- One database name.
- One logical data set group.
- From 1 to 255 segment types. Each defines the name of a logical segment type, and the name of the segment type or types in physical databases that are to be processed when a call is issued to process the logical segment type.

The logical relationships used to create a logical database must be defined in a physical database or databases.

All fields required for segments in a logical database must have been defined in physical databases.

DBD Generation Input Record Structure (Except for DEDB DBDs)

The DBDGEN program accepts ten types of control statements. Each control statement must be added to the SYSIN input stream in a specific order. Figure 1 on page 10 shows the rules for structuring DBD generation input.

Exception: This input record structure applies to all DBDs except DEDB DBDs.

The PRINT statement is optional. If included, it is the first statement in the input deck. When PRINT is not included, the DBD control statement is first in the input deck. One or more DATASET statements follow the DBD statement. Each DATASET statement is followed by the SEGM, LCHILD, FIELD, and XDFLD statements in that data set group. At least one SEGM statement must follow each DATASET statement. SEGM statements in the DBDGEN input set of records must be placed in the same hierarchic order as the segments in the database being defined.

FIELD and LCHILD statements follow the SEGM statement to which they apply. When a FIELD statement defines a sequence field within a segment, it must precede any XDFLD statements or any other FIELD statements that follow a SEGM

statement. LCHILD statements follow the SEGM that defines a logical parent, HIDAM and PHIDAM root, and index target and index pointer segment types. When you are defining a secondary index relationship, the LCHILD statement that establishes the relationship must be followed by its corresponding XDFLD statements. No unrelated LCHILD statements can intervene between the two. XDFLD statements follow a SEGM that defines an index target segment type for a secondary index. A separate input set of records is required for each database.

Requirement: The DBDGEN statement is required.

If FINISH is used, it precedes the END statement. END is the last statement in the input record structure.

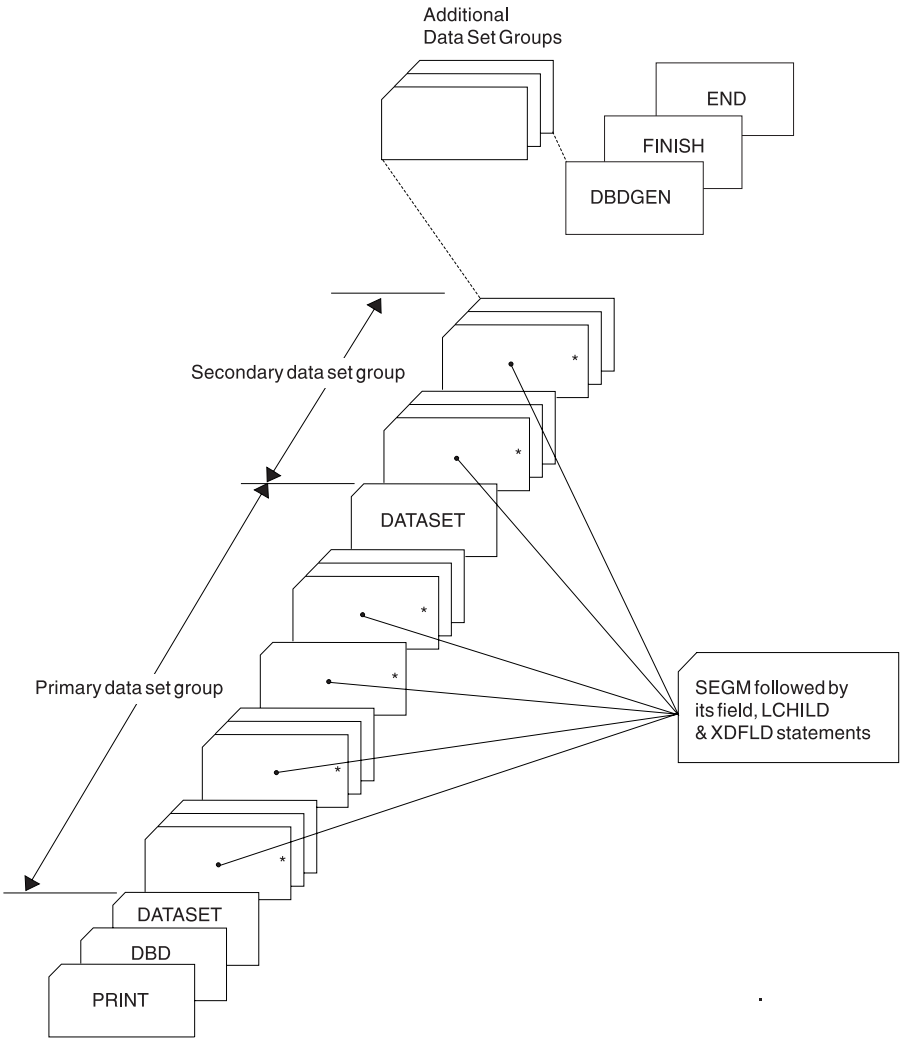


Figure 1. DBDGEN Input Record Structure (Except DEDB)

DEDB DBD Generation Input Record Structure

The input record set structure for a DEDB DBD generation is essentially the same as for the other types of DBD generation except that AREA statements are used instead of DATASET statements. All AREA statements must immediately follow the DBD statement. The SEGM statements and their associated FIELD statements follow the last AREA statement in hierarchic order. SEGM statements must also be placed in the same hierarchic order as the segments in the database being defined.

For DEDB DBD generation:

- The data set group concept does not apply.
- A secondary index is not permitted.
- Logical relationships between databases are not permitted.
- LCHILD and XDFLD statements are not permitted.
- Sequential dependent segments cannot have dependents.
- A separate input set of records is required for each database.

Figure 2 shows the rules for structuring a DEDB DBD generation input set of records.

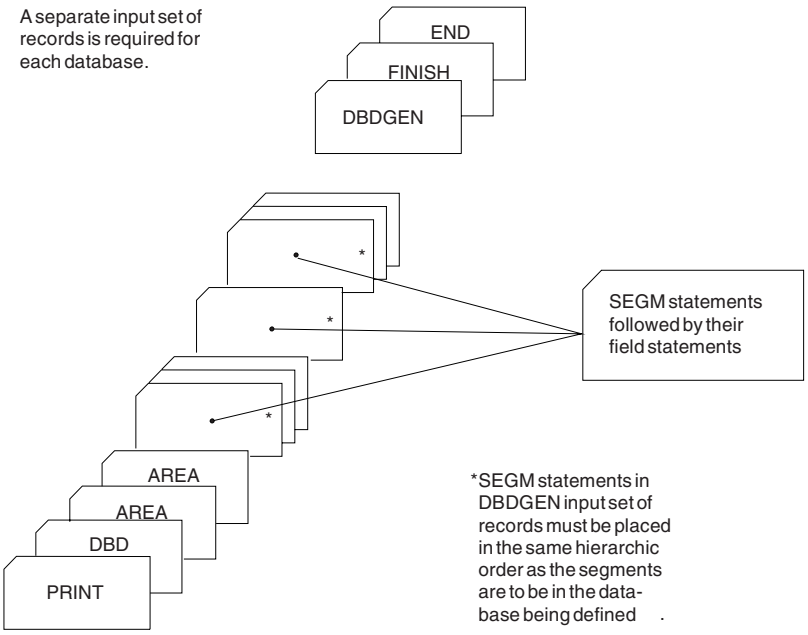


Figure 2. DEDB DBDGEN Input Record Structure

DBD Generation Coding Conventions

DBD generation statements are assembler language macro instructions and therefore are subject to the rules contained in the *HLASM MVS & VM Programmer's Guide*.

Each control statement must be identified by an operation code, for example: record-type code.

DBDGEN Procedure

Stage 2 of system definition causes the DBDGEN procedure to be placed in the IMS.PROCLIB library.

This is a two step assemble and link-edit procedure to produce database definition blocks (DBDs).

Procedure Statement

An example of the JCL for the DBDGEN utility is shown in Figure 3 on page 12.

```
//       PROC MBR=TEMPNAME,SOUT=A,RGN=0M,SYS2=
//C      EXEC PGM=ASMA90,REGION=&RGN,
//            PARM=(OBJECT,NODECK,NODBCS,
//            'SIZE(MAX,ABOVE)')
//SYSLIB   DD DSN=IMS.&SYS2.SDFSMAC,DISP=SHR
//SYSLIN   DD UNIT=SYSDA,DISP=(,PASS),
//         SPACE=(80,(100,100),RLSE),
//         DCB=(BLKSIZE=80,RECFM=F,LRECL=80)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(300,300),RLSE,,ROUND)
//SYSUT1   DD UNIT=SYSDA,DISP=(,DELETE),
//         SPACE=(CYL,(10,5))
//L      EXEC PGM=IEWL,PARM='XREF,LIST',
//            COND=(0,LT,C),REGION=4M
//SYSLIN   DD DSN=*.C.SYSLIN,DISP=(OLD,DELETE)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(90,90),RLSE)
//SYSLMOD  DD DISP=SHR,
//         DSN=IMS.&SYS2.DBDLIB(&MBR)
//SYSUT1   DD UNIT=(SYSDA,SEP=(SYSLMOD,SYSLIN)),
//         SPACE=(1024,(100,10),RLSE),DISP=(,DELETE)
```

Figure 3. JCL for DBDGEN Utility

Invoking the Procedure

To process a request for a DBDGEN, the DBD generation control statements must be created and appended to the JCL (shown in Figure 4) which invokes the DBDGEN procedure.

```
//DBDGEN  JOB MSGLEVEL=1
//       EXEC DBDGEN,MBR=
//C.SYSIN  DD  *

       DBD
       DATASET
       SEGM
       FIELD       DBD generation control statements
       LCHILD
       XDFLD
       DBDGEN
       FINISH
       END
/*
```

Figure 4. Procedure to Invoke DBDGEN

JCL Parameters

MBR=

Is the name of the DBD to be generated. This name should be the same as the first name specified for the NAME= keyword on the DBD statement. The first database name becomes the DBD member name and, in the case of a shared secondary index, the additional names are added as aliases. When a database PCB relates to this DBD generation, one of the names specified in the NAME= keyword on the DBD statement must be the name used in the DBDNAME= keyword on the database PCB statement. Except for a shared secondary index, the name used in the DBDNAME= keyword on the database PCB statement must be the same as the name used in the MBR= keyword value.

RGN=
Specifies the region size for this execution. The default is 256KB.

SOUT=
Specifies the class assigned to SYSOUT DD statements.

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS2='IMSA.'.

Step C
Step C is the assembly step.

DD Statements:

SYSIN DD
Defines the input data sets to step C. These DD statements must be provided when invoking the procedure.

Related Reading: Refer to *HLASM MVS & VM Programmer's Guide* for information on assembling steps.

Step L
Step L is the link-edit step.

Example: This step can be run using AMODE=31, RMODE=24 instead of the default AMODE=24, RMODE=24 by adding AMODE=31 to the link-edit EXEC statement PARM list as shown as follows:

```
//L      EXEC  PGM=IEWL,PARM='XREF,LIST,AMODE=31',
//             COND=(0,LT,C),REGION=120K
```

If you do not specify different values for AMODE or RMODE, the default values are in effect. You must always run the link-edit step with RMODE=24.

Related Reading: Refer to *z/OS MVS Program Management: User's Guide and Reference* for more information about linkage editors.

DD Statements:

IMS.DBDLIB DD
Defines an output partitioned data set, IMS.DBDLIB, for the linkage editor.

DBDGEN Statements

Table 2 shows the statement instruction types used as input to the DBD generation utility to define a database. Also included is the general use of each statement and the number of each type used per DBD generation.

Table 2. DBD Generation Statement Instruction Summary

PCB Macro	General Use	Number used per DBD generation										
		HSAM	GSAM	HISAM/ HDAM	PHDAM	HIDAM	PHIDAM	MSDB	DEDB	Index	PSINDEX	Logical
[PRINT] [1]	Controls printing of assembly listing if present	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1	0-1

Table 2. DBD Generation Statement Instruction Summary (continued)

PCB Macro	General Use	Number used per DBD generation										
		HSAM	GSAM	HISAM/ HDAM	PHDAM	HIDAM	PHIDAM	MSDB	DEDB	Index	PSINDEX	Logical
DBD[5]	Defines database name	1	1	1	1	1	1	1	1	1	1	1
DATASET	Defines a data set group within a database	1	1	1/1-10	N/A	1-10	N/A	1	0	1	N/A	1
AREA[5]	Defines an area within a Fast Path database	0	0	0	0	0	0	0	1-240	0	0	
SEGM	Defines a segment type within a data set group or area	1-255	0	1-255	1-255	1-255	1-255	1	1-127	1[2]	1[2]	1-255
[LCHILD]	Defines a logical or index relation —ship between segment types	0	0	0-255	0-255	1-255	1-255	0	0	1[2]	1[2]	0
[FIELD][3]	Defines a field within a segment type	0-1000	0	1-1000	0-1000	1-1000	1-1000	0-255	1-1000	1[4]	1[4]	0
[XDFLD][3]	Defines fields used with secondary indexes	0	0	0-1000	0-1000	0-1000	0-1000	0	0	0	0	0
DBDGEN	Indicates the end of DBD generation statements	1	1	1	1	1	1	1	1	1	1	1
FINISH	Checks for successful DBD generation	1	1	1	1	1	1	1	1	1	1	1
END	Indicates end of DBD generation input to the z/OS assembler	1	1	1	1	1	1	1	1	1	1	1

Notes:

1. For parameter information, see *OS/VS-DOS/VSE-VM/370 Assembler Language*
2. Maximum of 16 for a secondary index database.
3. The maximum combined total of FIELD and XDFLD statements per DBD generation is 1000.
4. Maximum of 1000 for a secondary index database.
5. All Full Function Database names and DEDB area names must be unique.

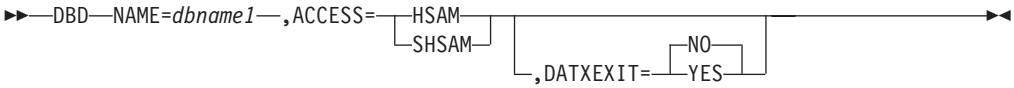
DBD Statement

The DBD statement names the database being described and provides DL/I with information concerning its organization. There can be only one DBD control statement in the control statement input deck.

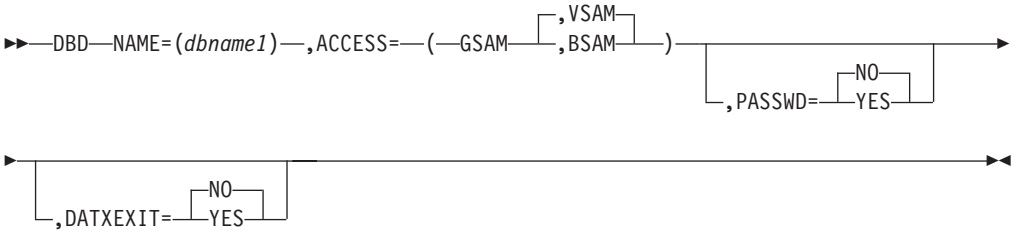
The format of the DBD macro instruction for each database type is shown in the following examples. A description of the statement parameters is in “DBD Statement Parameter Descriptions” on page 22.

For details on the coding format for assembler macro instructions, refer to the ″Assembler Coding Conventions″ topic in the *IBM Assembler Manual*, publication number SC26-4940-03.

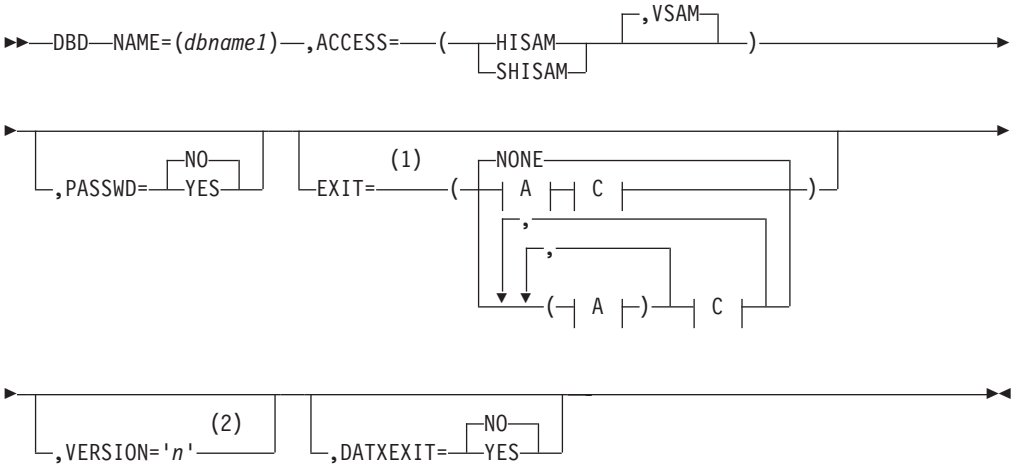
HSAM Database DBD Statement



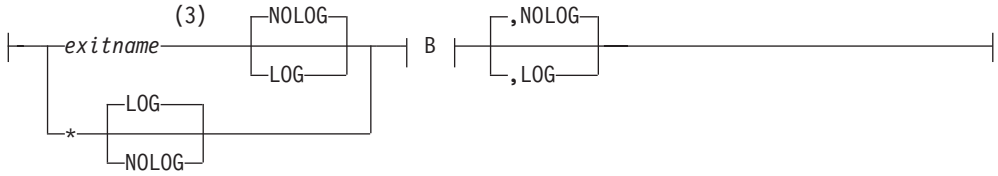
GSAM Database DBD Statement



HISAM Database DBD Statement



A:



B:

C:

Notes:

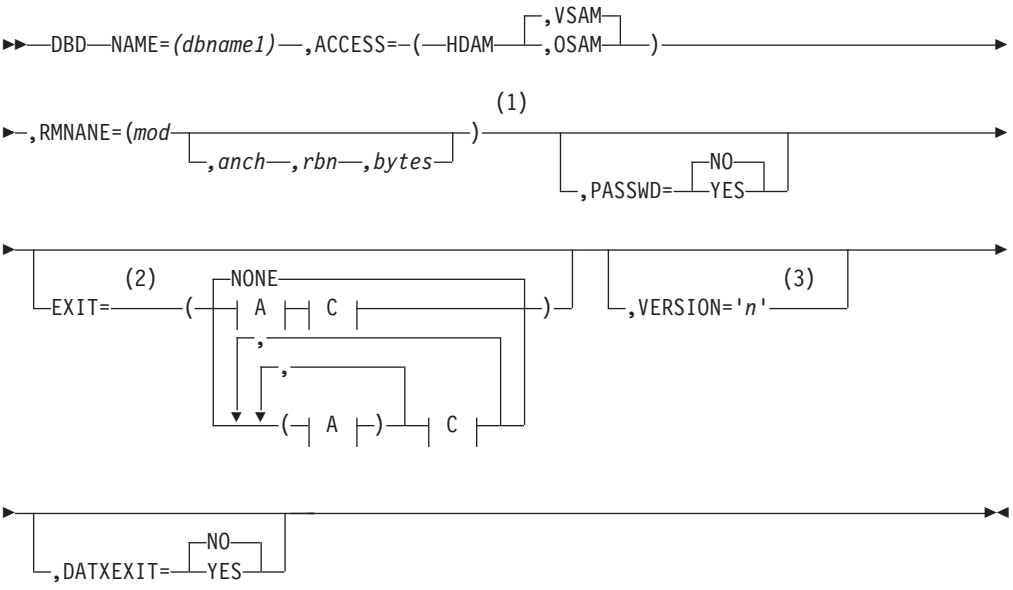
1 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

2 The default is an automatic DBDGEN time stamp.

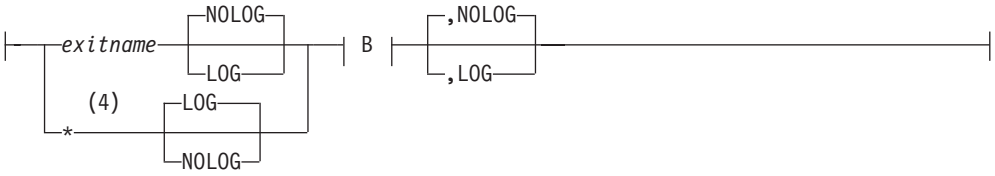
3 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you do specify an exit routine name, the default logging parameter is NOLOG.

4 Used to control the CASCADE options.

HDAM Database DBD Statement



A:



B:

C:

Notes:

1 Optional operands, such as anch and rbn, might be required by certain randomizing modules. See the documentation for the randomizing module you are using.

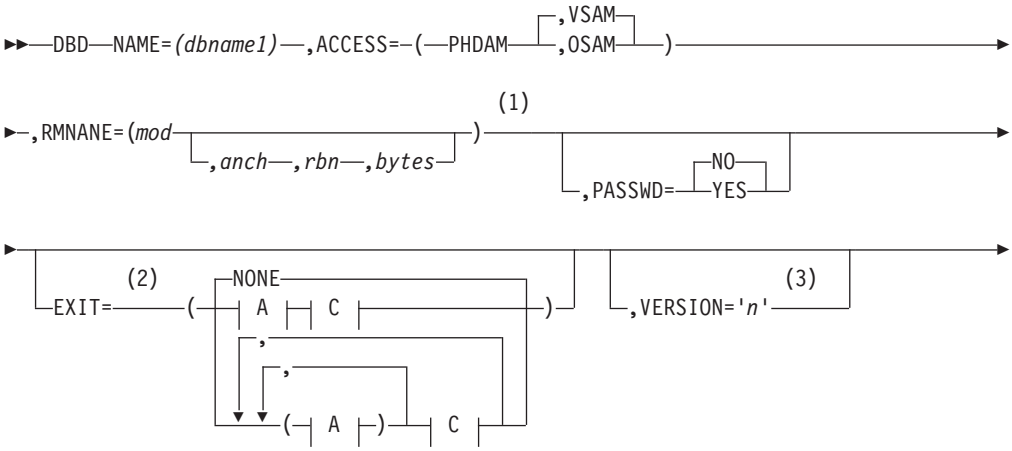
2 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

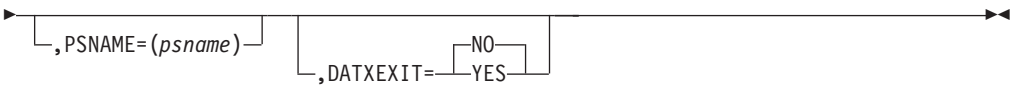
3 The default is an automatic DBDGEN time stamp.

4 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you do specify an exit routine name, the default logging parameter is NOLOG.

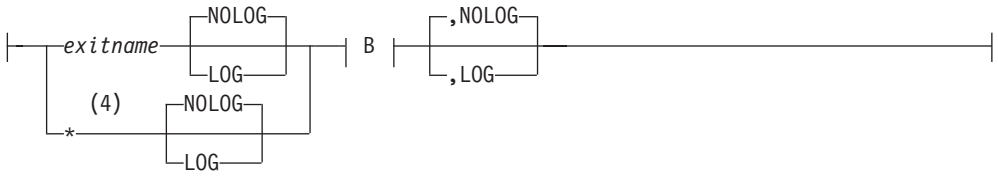
5 Used to control the CASCADE options.

PHDAM Database DBD Statement





A:



B:

C:

Notes:

1 Optional operands, such as anch and rbn, might be required by certain randomizing modules. See the documentation for the randomizing module you are using.

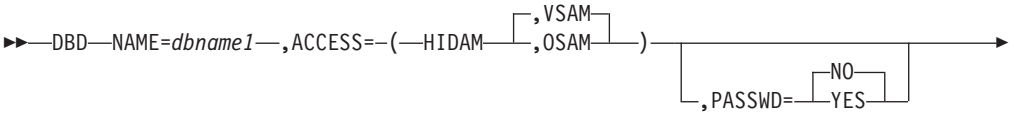
2 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

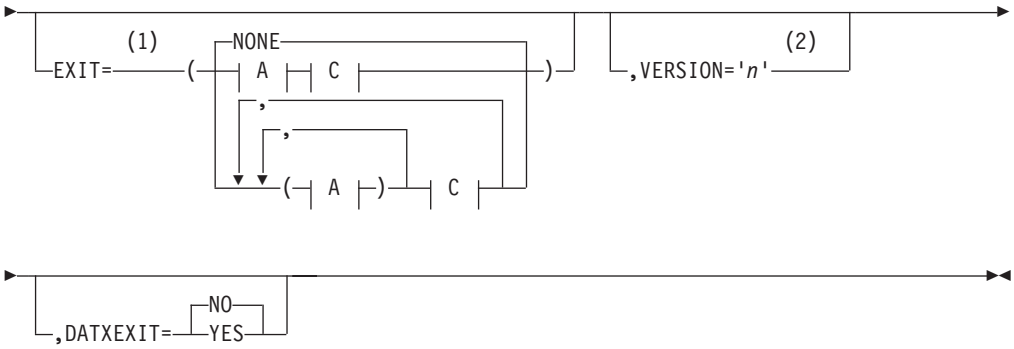
3 The default is an automatic DBDGEN time stamp.

4 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you specify an exit routine name, the default logging parameter is NOLOG.

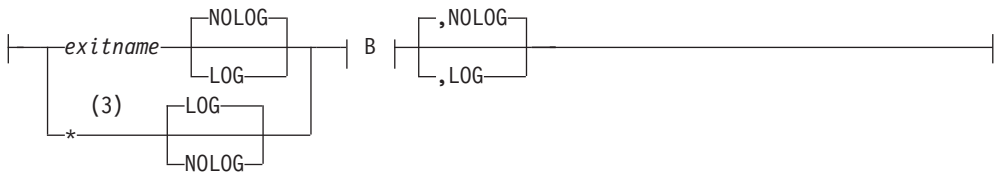
5 Used to control the CASCADE options.

HIDAM Database DBD Statement





A:



B:

C:

Notes:

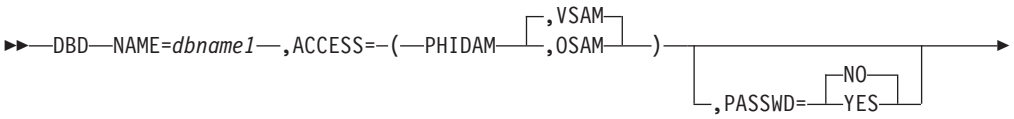
1 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

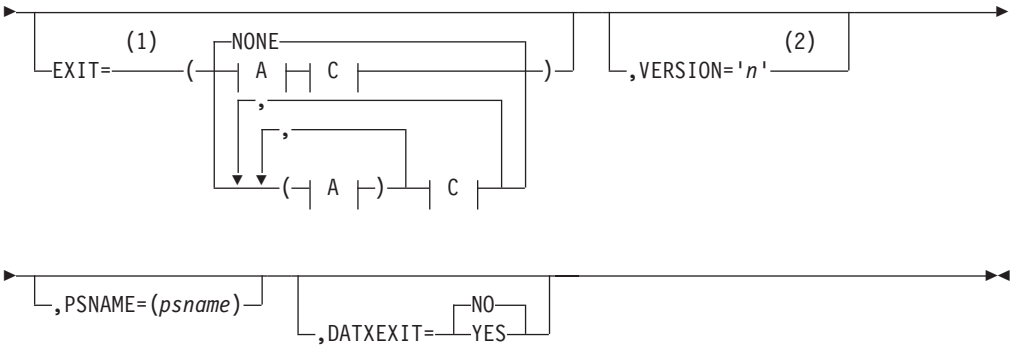
2 The default is an automatic DBDGEN time stamp.

3 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you do specify an exit routine name, the default logging parameter is NOLOG.

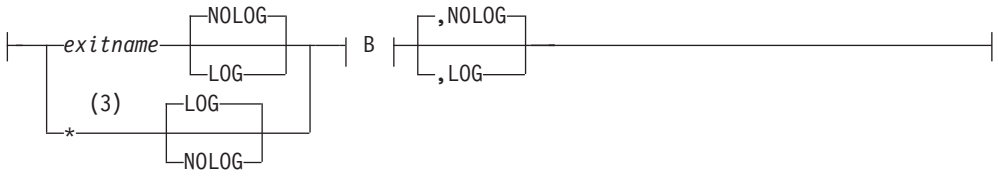
4 Used to control the CASCADE options.

PHIDAM Database DBD Statement





A:



B:

C:

Notes:

1 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

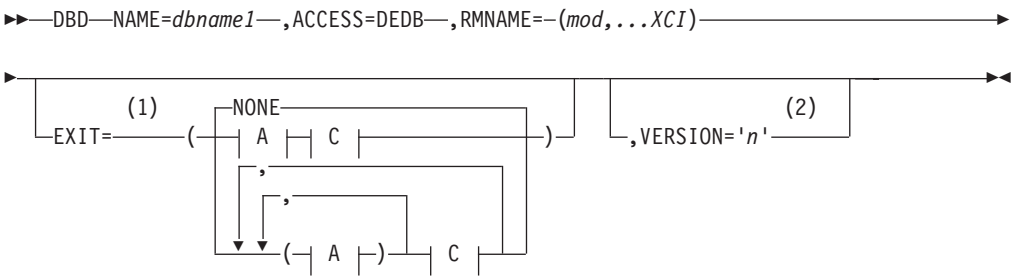
2 The default is an automatic DBDGEN time stamp.

3 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you specify an exit routine name, the default logging parameter is NOLOG.

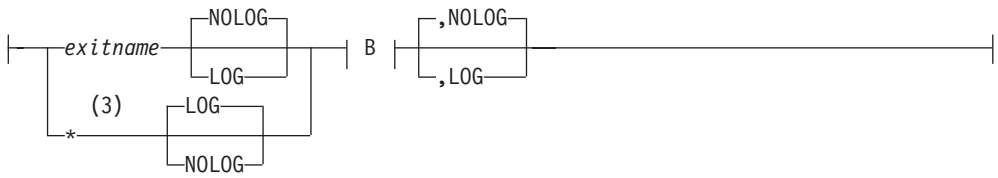
4 Used to control the CASCADE options.

MSDB Database DBD Statement

DEDB Database DBD Statement



A:



B:

C:

Notes:

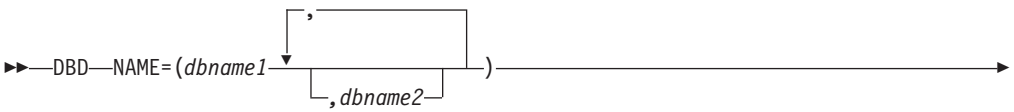
1 Used for the Data Capture exit routine. You can specify more than one exit routine on a DBD statement.

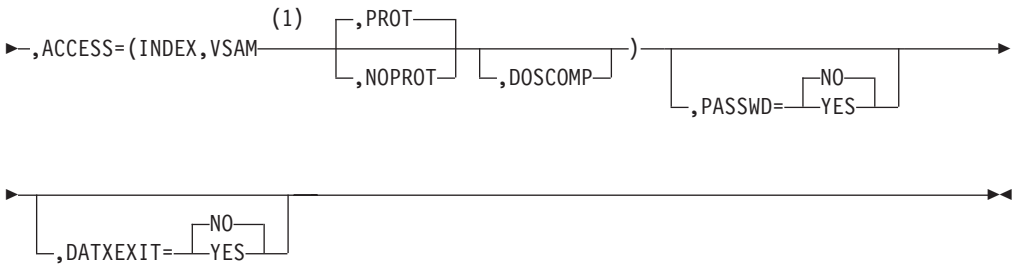
2 The default is an automatic DBDGEN time stamp.

3 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you do specify an exit routine name, the default logging parameter is NOLOG.

4 Used to control the CASCADE options.

INDEX Database DBD Statement

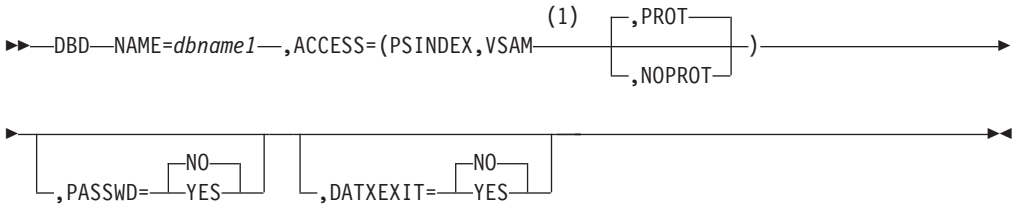




Notes:

1 A secondary index must use VSAM.

PSINDEX Database DBD Statement



Notes:

1 A secondary index must use VSAM.

LOGICAL Database DBD Statement

DBD Statement Parameter Descriptions

DBD
Identifies this statement as the DBD control statement.

NAME=
Specifies the name of the DBD for the database being described. The name can be from 1 to 8 alphanumeric characters and can be the same as that specified in the DD1= parameter of the first DATASET control statement. For a shared secondary index database, the names of up to 16 secondary index DBDs can be specified.

Do not give a DBD the same name as an existing PSB. Using an existing name can cause unpredictable results. An error occurs at ACB generation time.

ACCESS=
Specifies the DL/I access method and the operating system access method to be used for this database. This keyword also defines the secondary index database as a HALDB. The value of the parameter has the following meaning:

HSAM
Means the hierarchical sequential access method (HSAM) is to be used for

the database described by this DBD. When HSAM is specified, and only one segment type is defined in the HSAM database, this parameter defaults to SHSAM.

SHSAM
Specifies a simple HSAM database that contains only one fixed length segment type. When a simple HSAM database is defined, no prefix is required in occurrences of the segment type to enable IMS to process the database.

GSAM
Means the generalized sequential access method (GSAM) is to be used for the database described by the DBD. BSAM or VSAM can be specified as the operating system access method. VSAM is the default. When GSAM is specified, no SEGM control statement is allowed in the DBD generation.

HISAM
Means the hierarchical index sequential access method (HISAM) is to be used for the database described by this DBD. VSAM can be specified as the operating system access method. It is the default.

SHISAM
Specifies a simple HISAM database that contains only one fixed length segment type. A simple HISAM database can only be specified when VSAM is specified as the operating system access method. When a simple HISAM database is defined, no prefix is required in occurrences of the segment type to enable IMS to process the database.

HDAM
Means the hierarchical direct access method (HDAM) is to be used for the database described by this DBD. OSAM or VSAM can be specified as the operating system access method. VSAM is the default.

PHDAM
Means the partitioned hierarchical direct access method (PHDAM) database is to be used for the database described by the DBD. OSAM or VSAM can be specified as the operating system access method. VSAM is the default.

HIDAM
Means the hierarchical indexed direct access method (HIDAM) is to be used for the database described by the DBD. OSAM or VSAM can be specified as the operating system access method. VSAM is the default.

PHIDAM
Means the partitioned hierarchical indexed direct access method (PHIDAM) database is to be used for the database described by the DBD. OSAM or VSAM can be specified as the operating system access method. VSAM is the default.

MSDB
Means a main storage database (MSDB) is described by the DBD.

DEDB
Means a data entry database (DEDB) is described by the DBD.

INDEX
Creates the primary index to occurrences of the root segment type in a HIDAM database, or creates a secondary index to a segment type in a HISAM, HDAM or HIDAM database. For the primary or secondary index to a HIDAM database, VSAM must be specified as the operating system access method.

The INDEX parameter is not used to define the primary index of a PHIDAM database.

PROT or NOPROT
Applies only to secondary index databases. The PROT parameter on the DBD statement is an optional parameter that is used to ensure the integrity of all fields in index pointer segments that are used by IMS. Use of this parameter prevents an application program from doing a replace operation on any field within an index pointer segment except for fields within the user data portion of index pointer segments. When PROT is specified, delete operations are still enabled for index pointer segments. If PROT is specified and a delete is issued for an index pointer segment, the index target segment pointer in the index pointer segment is deleted. However, the index source segment that caused the index pointer segment to be created originally is not deleted. If NOPROT is specified, an application program can replace all fields within an index pointer segment except the constant, search, and subsequence fields. Inserts to an index database are invalid under all conditions. PROT is the default for this parameter.

DOSCOMP
Must be specified if the database is an index, and it was created using DLI/DOS. DLI/DOS index databases contain a segment code as part of the prefix. Selection of the DOSCOMP parameter causes IMS to expect this code to be present in the defined database, and to process in a way that preserves this code. This includes providing a segment code for new segments being inserted. The DOSCOMP parameter can only be specified for databases that use VSAM. The DOSCOMP parameter is not supported for PHDAM, PHIDAM, or PSINDEX databases.

PSINDEX
Creates the partitioned secondary index to a segment type in PHDAM and PHIDAM databases. VSAM must be specified as the operating system access method. VSAM is the default.

PROT or NOPROT
Applies only to secondary index databases. The PROT parameter on the DBD statement is an optional parameter that is used to ensure the integrity of all fields in index pointer segments that are used by IMS. Use of this parameter prevents an application program from doing a replace operation on any field within an index pointer segment except for fields within the user data portion of index pointer segments. When PROT is specified, delete operations are still enabled for index pointer segments. If PROT is specified and a delete is issued for an index pointer segment, the index target segment pointer in the index pointer segment is deleted. However, the index source segment that caused the index pointer segment to be created originally is not deleted. If NOPROT is specified, an application program can replace all fields within an index pointer segment except the constant, search, and subsequence fields. Inserts to an index database are invalid under all conditions. PROT is the default for this parameter.

LOGICAL
Means that the database described by this DBD is a LOGICAL database. A LOGICAL database is composed of one or more physical databases. A LOGICAL DBD generation is meaningful only when physical DBD generations exist that define the segment types that are referenced by SEGM statements in a LOGICAL DBD generation.

PSNAME=

Specifies the module that selects the HALDB partition for PSINDEX, PHDAM, or PHIDAM databases. The parameter parameter is a HALDB partition selection exit routine module name. This parameter is only valid when ACCESS=PSINDEX, PHDAM, or PHIDAM is specified.

Exception: A user-provided HALDB partition selection routine is not needed if root key ranges define HALDB partition membership.

RMNAME=

Specifies information used to manage data stored in a DEDB or in the primary data set group of an HDAM or PHDAM database. This parameter is only valid when ACCESS=HDAM, PHDAM, or DEDB is specified. The parameters of this parameter are defined in the list that follows. A randomizing module controls root segment placement in or retrieval from the DEDB, HDAM, or PHDAM database. One or more modules, called randomizing modules, can be utilized within the IMS system. A particular database has only one randomizing module associated with it. A generalized module, which uses DBD generation-supplied parameters to perform randomizing for a particular database, can be written to service several databases. The purpose of a randomizing module is to convert a value supplied by an application program for root segment placement in, or retrieval from, a DEDB, HDAM, or PHDAM database into a relative block number and anchor point number. You can randomize within an area by selecting a two-stage randomizer. When you select a two-stage randomizer, the number of root anchor points in an area can be changed without having to stop all areas in the DEDB with the `/DBRECOVERY` command.

For PHDAM databases, the randomizer module names and values become the default for each partition. You can set a different randomizer name and values for each partition during HALDB partition definition. HALDB partition selection is done prior to invoking the randomizing module. The randomizing module selects locations only within a partition.

mod

Specifies the 1- to 8-character alphanumeric name of a user-supplied randomizing module that is used to store and access segments in this DEDB, PHDAM, or HDAM database. Select a two-stage randomizer by specifying the randomizer name in the mod parameter and 2 in the anchor point parameter.

Related Reading: Refer to *IMS Version 9: Customization Guide* for further examples of HDAM, PHDAM, and Fast Path DEDB randomizing modules.

anch

Specifies the number of root anchor points desired in each control interval or block in the root addressable area of an HDAM or PHDAM database. The default value of this parameter is one. The anch parameter must be an unsigned decimal integer and must not exceed 255. Typical values are from 1 to 5. Select a two-stage randomizer by specifying the randomizer name in the mod parameter and 2 in the anchor point parameter.

When a user randomizing routine produces an anchor point number greater than the number specified for this parameter, the anchor point used is the highest numbered one in the control interval or block. When a randomizing routine produces an IMS anchor point number of zero, IMS uses anchor point one in the control interval or block.

The number of root anchor point for the DEDB is always 1.

rbn

Specifies the maximum relative block number value that the user wants to allow a randomizing module to produce for this database. This parameter is for HDAM or PHDAM databases only. This value determines the number of control intervals or blocks in the root addressable area of an HDAM or PHDAM database. The rbn parameter must be an unsigned decimal integer whose value does not exceed 2^{24}-1. If this parameter is omitted, no upper limit check is performed on the rbn created by the randomizing module. If this parameter is specified, but the users randomizing module produces an rbn greater than this parameter, the highest control interval or block in the root addressable area is used by IMS. If a user randomizing module produces a block number of zero, control interval or block one is used by IMS.

In an HDAM, PHDAM, HIDAM, or PHIDAM OSAM data set, the first bit map is in the first block of the first extent of the data set. In an HDAM, PHDAM, HIDAM, or PHIDAM database, the first control interval or block of the first extent of the data set specified for each data set group is used for a bit map. In a VSAM data set, the second control interval is used for the bit map and the first control interval is reserved. IMS adds one to the block calculated by the randomizer.

bytes

Specifies the maximum number of bytes of database record that can be stored into the root addressable area in a series of inserts unbroken by a call to another database record. This parameter is for HDAM and PHDAM databases only. If this parameter is omitted, no limit is placed on the maximum number of bytes of a database record that can be inserted into this database's root segment addressable area. The bytes parameter must be an unsigned decimal integer whose value does not exceed 2^{24}-1. When the "rbn" parameter is omitted, the "bytes" parameter is ignored, which in turn, leaves no limit on the number of bytes of a database record that can be inserted into the root addressable area.

If the "bytes" parameter is specified for an HDAM or PHDAM database and the length of the database record is larger, the remainder of the record is inserted into the overflow area following the current end-of-file (EOF). This requires that enough space be available after the current EOF to contain the remainder of all database records that exceed the "bytes" specification. If sufficient space is not available in the overflow area following the current EOF, the database records are inserted randomly in the database.

XCI

Specifies that this DEDB uses the Extended Call Interface when making calls to the randomizer. This option allows the randomizer to be called in three different ways. On initialization of IMS or during a `/START DB` command, IMS will first load the randomizer and then make an `INIT` call to the randomizer to invoke its initialization routines. During a `/DBR DB` command, IMS will make a `TERM` call to the randomizer to invoke the termination routines before unloading the randomizer. The normal randomizing call to the randomizer is made when the application issues a `GU` or `ISRT` call on a root segment. The `XCI` option is only valid for DEDBs.

PASSWD=

Prevents accidental access of IMS databases by non-IMS programs.

YES

Causes DL/I open to use the DBDNAME for this DBD as the VSAM password when opening any data set for this database. This parameter is

only valid for DBDs that use VSAM as the access method. PASSWD=YES is invalid for ACCESS=LOGICAL, MSDB, or DEDB. When the user defines the VSAM data sets for this database using the DEFINE statement of z/OS Access Method Services, the control level (CONTROLPW) or master level (MASTERPW) password must be the same as the DBDNAME for this DBD. All data sets associated with this DBD must use the same password.

Related Reading: For a description of the use and format of passwords for VSAM, see *z/OS DFSMS Access Method Services for Catalogs*.

For the IMS DB/DC system, all VSAM OPENs bypass password checking and thus avoid operator password prompting. For the IMS DB system, VSAM password checking is performed. In the batch environment, operator password prompting occurs if PASSWD=NO is specified and the data set is password protected at the control level (CONTROLPW) with passwords not equal to DBDNAME.

NO
Specifies that the DBDNAME for this DBD should not be used as the VSAM password. NO is the default.

EXIT=
Specifies that the Data Capture exit routine is used. You can specify multiple exit routine names on a single DBD statement. You can select different data options for each exit routine. The order you list the exit routines within the parameter determines the order the exit routines are called for the segment.

When specified on the DBD statement, the EXIT= parameter applies to all segments within the physical database. The following physical databases are supported by this exit routine:

- HISAM
- HDAM
- PHDAM
- HIDAM
- PHIDAM
- SHISAM
- DEDB

If the exit routine is not specified for a supported database organization or a supported segment type, DBDGEN fails.

Related Reading: For more information about this exit routine, see *IMS Version 9: Administration Guide: Database Manager*.

The EXIT= parameter can also be specified on the SEGM statement.

exit_name
Specifies the name of the exit routine that processes the data. This parameter is required. The name must follow standard naming conventions. A maximum of 8 alphanumeric characters is allowed. You can specify an asterisk (*) instead of an exit routine name to indicate that you want logging only. If this is done, the logging parameter default is LOG. If you **do** specify an exit routine, the logging parameter default is NOLOG. All of the following operands are optional.

KEY
Specifies the exit routine is passed the physical concatenated key. This key identifies the physical segment updated by the application.

KEY is the default.

NOKEY
Can be specified when the physical concatenated key is not required for the exit routine.

NOKEY is optional.

DATA
Specifies that the physical segment data is passed to the exit routine for updating. When DATA is specified and a Segment Edit/Compression exit routine is also used, the data passed is expanded data.

DATA is the default.

NODATA
Can be specified when the exit routine does not require segment data. Use NODATA to avoid the overhead created from saving physical segment data.

NODATA is optional.

NOPATH
Indicates the exit routine does not require data from segments in the physical root's hierarchical path. NOPATH is an efficient way to avoid the processing time needed to retrieve path data.

NOPATH is the default.

PATH
Can be specified when the data from each segment in the physical root's hierarchical path must be passed to the exit routine for an updated segment. Use PATH to allow an application to separately access several segments for insertion, replacement, or deletion.

You can use the PATH option when information from segments in the path is needed to compose the DB2 primary key. The DB2 primary key would then be used in a propagation request for a dependent segment update. Typically, you need this kind of segment information when the parent contains the key information and the dependent contains additional data that would not fit in the parent segment.

You can also use PATH when additional processing is necessary. It could be that you are not accessing several segments with one call; for example, you did not invoke the D command code. In this case, additional processing is necessary if the application is to access each segment with a separate call.

PATH is optional.

CASCADE
Indicates the exit routine is called when DL/I deletes this segment because the application deleted a parent segment. Using CASCADE ensures that data is captured for the defined segment.

Related Reading: For a detailed discussion of delete rules for the Data Capture exit routine, see *IMS Version 9: Administration Guide: Database Manager*.

CASCADE is the default.

The CASCADE parameter has three suboptions. These suboptions control the way data is passed to the exit routine. If you specify suboptions, you must enclose the CASCADE parameter and the suboptions within parentheses.

KEY
Passes the physical concatenated key to the exit. This key identifies the segment being deleted by a cascade delete.

KEY is the default.

NOKEY
Can be used when the exit routine does not require the physical concatenated key of the segment being deleted.

NOKEY is optional.

DATA
Passes segment data to the exit routine for a cascade delete. DATA also identifies the segment being deleted when the physical concatenated key is unable to do so.

DATA is the default.

NODATA
Can be specified when the exit routine does not require segment data. NODATA reduces the significant storage and performance requirements that result from saving physical segment data.

NODATA is optional.

NOPATH
Indicates the exit routine does not require segment data in the physical root's hierarchical path. Use NOPATH to eliminate the substantial amount of path data needed for a cascade delete.

NOPATH is the default.

PATH
Can be specified to allow an application to separately access several segments for a cascade delete.

PATH is optional.

NOCASCADE
Indicates the exit routine is not called when DL/I deletes this segment. Cascade delete is not necessary when a segment without dependents is deleted.

NOCASCADE is optional.

LOG
Requests that the data capture control blocks and data be written to the IMS system log.

NOLOG
Indicates that no data capture control blocks or data is written to the IMS system log.

VERSION(*character string***)**
Specifies a character string used to identify the DBD. The exit routine is passed this character string so it can determine the DBD version used to update the database.

character string
The character-string length can be up to 255 bytes. There are no checks to ensure that the proper values have been inserted. Therefore, it is important that the variable-length character string be updated whenever the DBD changes.

If you do not specify a character string, a 13-character time stamp is generated by DBDGEN. It represents the date and time the DBDGEN was completed. Its format is:

```
MM/DD/YYHH.MM
```

Where:

MM The month

DD The day of the month

YY The last two digits of the year

HH The hour on a 24-hour clock

MM The minutes

DATXEXIT=

Allows a user exit, DFSDBUX1, to be used by an application while processing this database. If no parameter is specified, NO is implied.

YES

Specifies that the user exit, DFSDBUX1, is called at the beginning and at the end of each database call. If DFSDBUX1 is not loaded, IMODULE is called to load it.

NO

Allows the user exit, DFSDBUX1, to be called, provided DFSDBUX1 is located in the SDFSRESL. If DGSDBUX1 does not need to be called again for the DBD, X'FF' is returned in the SRCHFLAG field in the JCB, and DFSDLA00 dynamically marks the DBD as not requiring the exit. In this case, the user exit is not called again for that DBD for the duration of the IMS session, unless the DMB is purged from the DMB pool.

DATASET Statements

A DATASET statement defines a data set group within a database.

Requirement: At least one DATASET statement is required for each DBD generation.

Restriction: Data set statements are not allowed for HALDBs. Partitions are defined outside DBDGEN.

DEDB databases use AREA statements, not DATASET statements (see "AREA Statement" on page 44).

The maximum number of DATASET statements used depends on the type of databases. Some databases can have only one data set group. Data Entry databases can have 1 to 2048 areas defined. HDAM and HIDAM databases can be divided into 1 to 10 data set groups subject to the rules in "Rules for Dividing a Database into Multiple Data Set Groups" on page 31.

In the DBDGEN input deck, a DATASET statement precedes the SEGM statements for all segments that are to be placed in that data set group. The first DATASET statement of a DBD generation defines the primary data set group. Subsequent DATASET statements define secondary data set groups.

Exception: The only exception to the order of precedence is when the LABEL field of a DATASET statement is used. Refer to “Use of the LABEL Field” on page 32 for this exception.

Comments must not be added to a subsequent labeled DATASET macro that has no operands.

Rules for Dividing a Database into Multiple Data Set Groups

HDAM and HIDAM databases can be divided into a maximum of 10 data set groups according to the following restrictions. Each DATASET statement creates a separate data set group, except for the case explained in “Use of the LABEL Field” on page 32. The first DATASET statement defines the primary data set group. Subsequent DATASET statements define secondary data set groups.

For HDAM or HIDAM databases, you can use DATASET statements to divide the database into multiple data set groups at any level of the database hierarchy; however, the following restriction must be met. A physical parent and its physical children must be connected by physical child/physical twin pointers, as opposed to hierarchic pointers, when they are in different data set groups, as shown in Figure 5.

The connection between segment A (the root segment in the primary data set group), and segment B (a first level dependent in the secondary data set group) must be made using a physical child. The connection between segment C (a first level dependent in the primary data set group) and segment D (a second level dependent in the secondary data set group) must also be made using a physical child. The connection between multiple occurrences of segments B and D under one parent must be made using physical twin pointers.

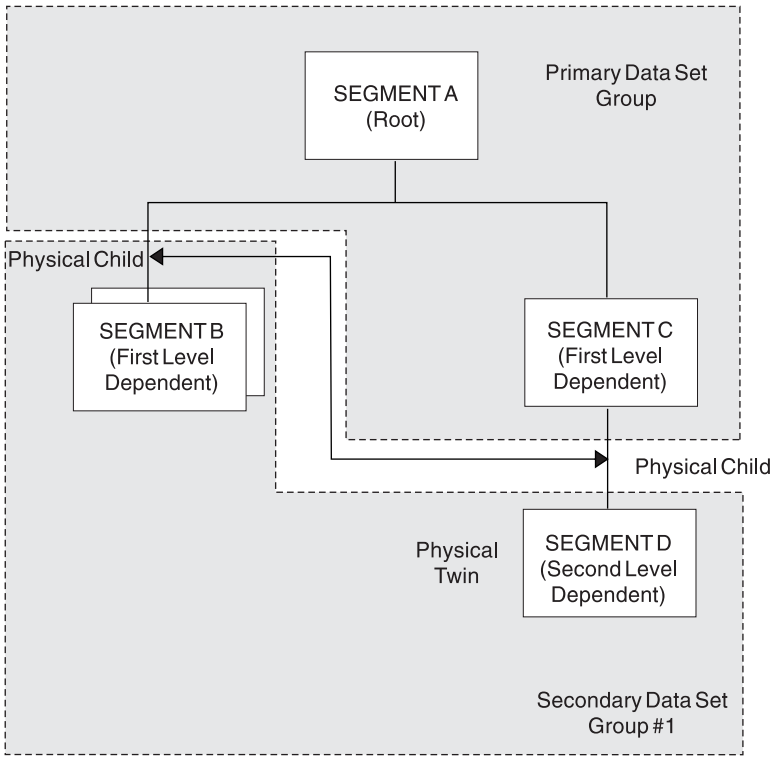


Figure 5. Connections through Physical Child and Physical Twin Pointers

Use of the LABEL Field

In HDAM or HIDAM databases, it is sometimes desirable to place segments in data set groups according to segment size or frequency of access rather than according to their hierarchic position in the data structure. To achieve this while still observing the DBD generation rule that the SEGM statements defining segments must be arranged in hierarchic sequence, the LABEL field of the DATASET statement is used.

An identifying label coded on a DATASET statement is referenced by coding the same label on additional DATASET statements. Only the first DATASET statement with the common label can contain operands that define the physical characteristics of the data set group. All segments defined by SEGM statements that follow DATASET statements with the same label are placed in the data set group defined by the first DATASET statement with that label.

You can use this capability in much the same manner as the CSECT statement of assembler language, with the following restrictions:

- A label used in the label field of a DATASET statement containing operands **cannot** be used on another DATASET statement containing operands.
- Labels must be alphanumeric and must be valid labels for an assembler language statement.
- Unlabeled DATASET statements must have operands.

Referring to Figure 5 on page 31, Table 3 illustrates use of the label field of the DATASET statement to group segment types of the same size in the same data set groups.

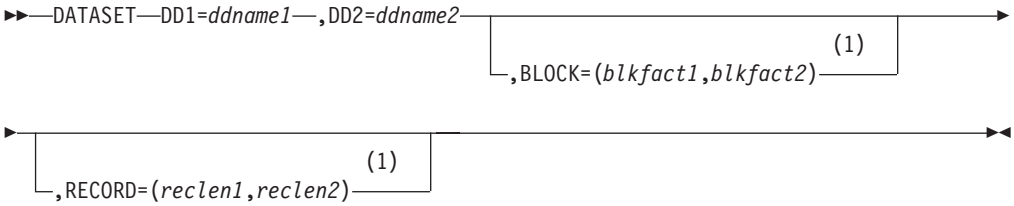
Table 3. Using the Label Field to Group Segment Types

Label	Operation	Parameter
N/A	DBD	NAME=HDBASE,ACCESS=HDAM, RMNAME=(RANDMODL,1,500,824)
DSG1	DATASET SEGM	DD1=PRIMARY,BLOCK=1648 NAME=SEGMENTA,BYTES=100
DSG2	DATASET SEGM	DD1=SECOND,BLOCK=3625 NAME=SEGMENTB,BYTES=50,PARENT=SEGMENTA
DSG1	DATASET SEGM	NAME=SEGMENTC,BYTES=100,PARENT=SEGMENTA
DSG2	DATASET SEGM	NAME=SEGMENTD,BYTES=50,PARENT=SEGMENTC
N/A	DBDGEN	N/A
N/A	FINISH	N/A
N/A	END	N/A

The segments named SEGMENTA and SEGMENTC exist in the first data set group. The segments named SEGMENTB and SEGMENTD exist in the second data set group.

The format of the DATASET statement for each database type is shown in the following examples. The parameters are described in “DATASET Statement Parameter Description” on page 35.

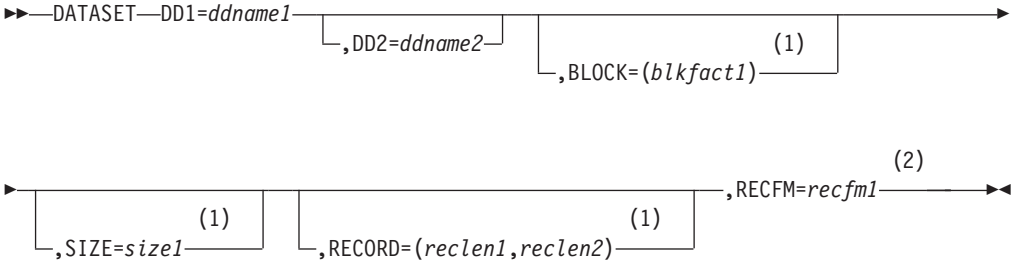
HSAM Database DATASET Statement



Notes:

1 If you do not specify a value, DBDGEN generates the value used.

GSAM Database DATASET Statement

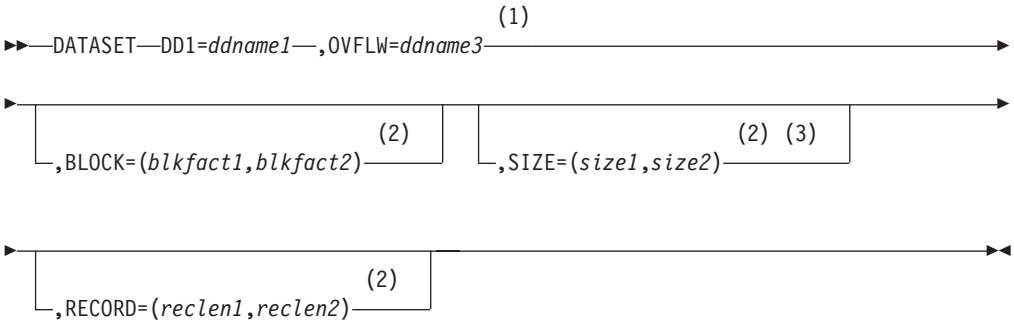


Notes:

1 If you do not specify a value, DBDGEN generates the value used.

2 RECFM is only valid for a GSAM database.

HISAM Database DATASET Statement



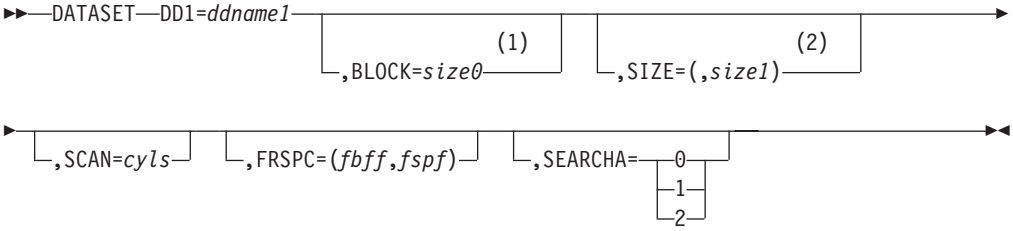
Notes:

1 If a HISAM database has only one segment type defined, you do not need to specify OVFLW. OVFLW is invalid in a simple HISAM database.

2 If you do not specify a value, DBDGEN generates the value used.

3 The valid parameter specifications for a SIZE keyword are 512 bytes, 1 KB, 2 KB, 4 KB, 8 KB, and multiples of 2 KB up to 28 KB.

HDAM Database DATASET Statement

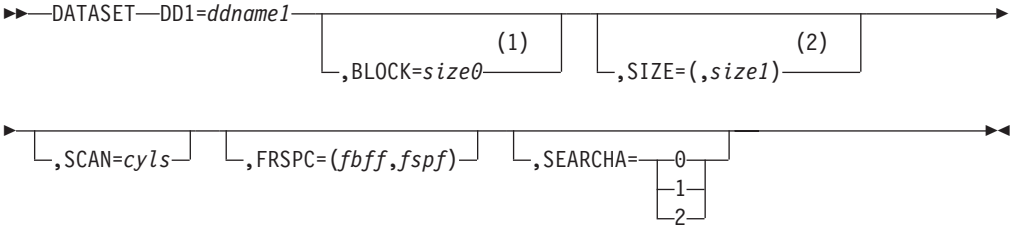


Notes:

1 If you do not specify a value, DBDGEN generates the value used.

2 The valid parameter specifications for a SIZE keyword are 512 bytes, 1 KB, 2 KB, 4 KB, 8 KB, and multiples of 2 KB up to 28 KB. To ensure future compatibility, use only CI sizes that are multiples of 4KB.

HIDAM Database DATASET Statement

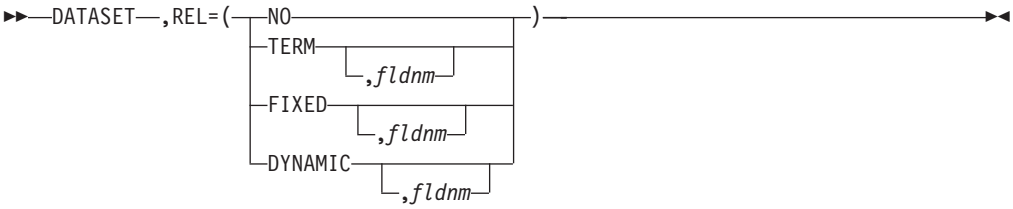


Notes:

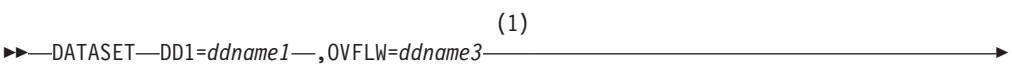
1 If you do not specify a value, DBDGEN generates the value used.

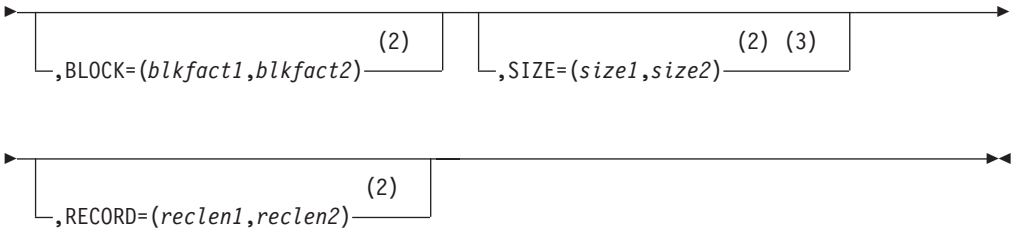
2 The valid parameter specifications for a SIZE keyword are 512 bytes, 1 KB, 2 KB, 4 KB, 8 KB, and multiples of 2 KB up to 28 KB. To ensure future compatibility, use only CI sizes that are multiples of 4 KB.

MSDB Database DATASET Statement



INDEX Database DATASET Statement





Notes:

1 If the keys of all the index segments are unique, you do not need to specify OVFLW.

2 If you do not specify a value, DBDGEN generates the value used.

3 The valid parameter specifications for a SIZE keyword are 512 bytes, 1 KB, 2 KB, 4 KB, 8 KB, and multiples of 2 KB up to 28 KB. To ensure future compatibility, use only CI sizes that are multiples of 4 KB.

LOGICAL Database DATASET Statement

DATASET Statement Parameter Description

DATASET
Identifies this as a DATASET control statement for a DL/I database.

LOGICAL
Indicates a logical database is being defined in this DBD generation. This parameter must be specified if the ACCESS=LOGICAL parameter is specified on this DBD generation's DBD statement. If LOGICAL is specified, all other operands are invalid; this must be the only DATASET statement for the DBD generation. The SEGM statements that follow this statement can only specify NAME=, PARENT=, and SOURCE= operands. No FIELD, XDFLD, or LCHILD statements can be used in a LOGICAL DBD generation.

DD1=
Specifies the ddname of the primary data set in this data set group. ddname1 must be a 1- to 8-character alphanumeric name. IMS use of the data set indicated by this parameter depends on the type of database being defined as shown in the following list:

Database Type	Use of the DD1= parameter
HSAM	ddname of input data set
GSAM	ddname of input data set
HISAM	ddname of primary data set in data set group
HIDAM	ddname of data set in data set group
HDAM	ddname of data set in data set group
MSDB	Parameter is invalid
DEDB	Name of defined area
INDEX	ddname of primary data set

LOGICAL Parameter is invalid

For an HSAM or GSAM database, this input data set is used when an application program retrieves data from the database.

DEVICE=
Specifies the physical storage device type on which the data set in this data set group is stored.

The default is 3380. If you code any other device, it will be ignored.

DD2=
Specifies the 1- to 8-character alphanumeric ddname of the output data set required for an HSAM or simple HSAM database and optional for a GSAM database. If it is omitted, ddname1 is assumed. This output data set is used by HSAM or GSAM when loading the database.

OVFLW=
Specifies the 1- to 8-character alphanumeric ddname of the overflow data set in this data set group. This parameter must be specified for:

- An INDEX database that contains index pointer segments with nonunique keys
- All data set groups of a HISAM database except when only one segment type is defined in the HISAM database

The ddnames used in DD1, DD2, or OVFLW subparameters must be unique within an IMS system or account. Nonunique ddnames in two or more DBDs might result in destruction of the database. One situation that can result in destruction of a database is if both ddnames were inadvertently used concurrently (both used in two different message regions of a data communications system or in two PCBs of one PSB used in a batch DL/I region of a database only system).

The following restrictions apply:

- The OVFLW parameter is not allowed when a simple HISAM database is defined.
- When a HISAM database that contains only one segment type is defined, the OVFLW parameter does not have to be specified.
- No OVFLW parameter on the DATASET statement is required for the index DBD because all index segments are inserted in the key sequenced data set of the index.

BLOCK=
Is used to specify the blocking factors (blkfact1, blkfact2) to be used for data sets in a data set group for HSAM, SHSAM, GSAM, HISAM, SHISAM, and INDEX databases, or is used to specify the block size or control interval size without overhead (size0) for the data set in a data set group for HDAM and HIDAM databases. Table 4 on page 37 explains the use of the BLOCK= and RECORD= operands.

For HISAM, SHISAM, and INDEX databases that use VSAM as the access method, use the SIZE= parameter to specify control interval size in place of the BLOCK= parameter. If the SIZE= keyword is used for a HISAM, SHISAM, or INDEX database, the BLOCK= keyword is invalid.

In cases where the RECORD= and BLOCK= operands are used, the resulting control interval size must be a multiple of 512 when the resulting size is less than 8192 bytes. If the product of the record length specified times the blocking factor specified plus VSAM overhead is not a multiple of 512 and is less than

8192 bytes, the resulting control interval size is obtained by rounding the value up to the next higher multiple of 512. Control interval sizes from 8192 to 30720 bytes (maximum allowed size) must be in multiples of 2048 bytes. When the product of the RECORD= and BLOCK= operands plus VSAM overhead is from 8192 to 30720 bytes but is not a multiple of 2048, the resulting control interval size is obtained by rounding the value up to the next higher multiple of 2048.

The VSAM overhead is 7 bytes if the blocking factor is 1; otherwise, it is 10 bytes. The maximum block size for OSAM data sets is 32 KB.

For HDAM and HIDAM databases, the BLOCK= parameter is used to enable you to override DBDGEN's computation of control interval or block size. However, in addition to the value specified in the BLOCK= parameter, DBDGEN adds space for root anchor points, a free space anchor point, and access method overhead. The block or control interval size that results can be determined by referring to the equations in the description of the SIZE= parameter or by examining the output of DBDGEN. If SIZE= is not specified and the access method is VSAM, DBDGEN calculates the best VSAM LRECL value by equally distributing any unused space in the CI to each logical record in the CI. If SIZE= is specified or the database is SHISAM, this is not done.

Table 4. BLOCK= and RECORD= Operands

Database Type	Use of BLOCK= and RECORD= Operands
HSAM	**BLOCK=** blkfact1 applies to input data set and should always be 1. blkfact2 applies to output data set and should always be 1. **RECORD=** reclen1 is the input record length. reclen2 is the output record length. **HSAM** is always unblocked; **LRECL** and **BLKSIZE** are equal.
GSAM	**BLOCK=** blkfact1 applies to input/output data set. blkfact2 is an invalid subparameter. **RECORD=** reclen1 is the size of an **LRECL** length or maximum size for a variable length record. reclen2 is the minimum size for a variable length record. **SIZE=** size1 is the **BLKSIZE** for input/output data set. size2 is an invalid subparameter.
HISAM	**BLOCK=** blkfact1 is the primary data set blocking factor. blkfact2 is the overflow data set blocking factor. **RECORD=** reclen 1 is the data set logical record length. reclen2 is the overflow data set logical record length.

Table 4. BLOCK= and RECORD= Operands (continued)

Database Type	Use of BLOCK= and RECORD= Operands
HIDAM HDAM	**BLOCK=** size0 is size without overhead of **OSAM** or **VSAM** data set group **RECORD=** Is ignored.
MSDB	**BLOCK=** and **RECORD=** operands are invalid
DEDB	**BLOCK=** and **RECORD=** operands are invalid.
INDEX	**BLOCK=** blkfact1 is the primary data set blocking factor. blkfact2 is the overflow data set blocking factor. **RECORD=** reclen1 is the primary data set logical record length. reclen2 is the overflow data set logical record length.
LOGICAL	**BLOCK=** and **RECORD=** operands are invalid.

Note: When both reclen1 and reclen2 are specified in a DATASET statement, reclen2 must be equal to or greater than reclen1, except for GSAM.

SIZE=

Is used to override DBDGEN's computation of control interval or block size. If the value specified for SIZE= is different from the control interval size defined to VSAM using the Access Method Services, DL/I uses the value defined to VSAM.

For DL/I DBDs, you can effectively modify the DBD without a DBDGEN by redefining the control interval size to VSAM using the Access Method Services. This allows you to migrate databases to new devices without a DBDGEN. When used, no overhead is added to the values specified and the value specified is not validated by IMS.

For VSAM data sets, when the values specified are less than 8192, they must be a multiple of 512. If not a multiple of 512, DBDGEN rounds the value specified to the next higher multiple of 512 and issue a warning message. Values specified in the range of 8192 to 30720 bytes (maximum allowed size) must be a multiple of 2048. If not a multiple of 2048, DBDGEN rounds the value specified to the next higher multiple of 2048 and issue a warning message.

For HISAM, SHISAM, primary HIDAM index, and secondary index databases, size1 specifies the control interval or block size of the primary data set in a data set group, and size2 specifies the control interval or block size of the overflow data set.

For HDAM and HIDAM databases, only the size1 parameter is used. The size1 parameter specifies the control interval or block size of the data set in the data set group.

When SIZE is specified for a HISAM or INDEX database, the RECORD parameter must also be specified; the size value specified must be a multiple of the record parameter in order to allow VSAM to open the data sets involved. Following are equations that show the minimum block or control interval size that you can specify for databases.

The maximum block size of OSAM data sets is 32767 bytes. An OSAM data set with an even length block size has an 8-gigabyte size limit. If the database is saved with image copy, 32752 bytes is the maximum amount that can be specified for the block size. Image copy processing module DFSUDMP0 adds 15 bytes to the block size for double-word alignment of its prefix, and the block size cannot exceed 32767. If the DBDGEN utility specifies the block size, 32752 bytes is the maximum amount specified.

Calculating SIZE= for HISAM Primary Data Set Groups, Primary HIDAM Index, and Secondary Index Data Set Groups

For the primary data set group of a HISAM or INDEX database, the minimum control interval size that can be specified for the primary data set is given by primary size and for the overflow data set by overflow size. The overflow data set is not always required in the data set group.

- primary size ≥ ROOTSEG + OVERHEAD + VSAM CONTROL
- overflow size ≥ MAXSEG + OVERHEAD + VSAM CONTROL

ROOTSEG=
Maximum root segment size including the segment prefix. An INDEX VSAM root segment prefix does not include a segment code, unless it was created using DL/I DOS.

OVERHEAD=
Number of bytes required is:

7 Used for OSAM, if the database has more then one physical segment type

3 Used for OSAM, if the database has only one physical segment type

4 Used for INDEX VSAM databases with nonunique root segment keys

0 Used for INDEX VSAM databases unique root segment keys, not created using DL/I DOS.

5 bytes for all other VSAM databases.

VSAM CONTROL=
Number of bytes required is:

0 Used for OSAM, if the blocking factor is 1

7 Used for VSAM if the blocking factor is 1

10 Used for all other cases

MAXSEG=
Length in bytes of the longest segment in this data set group including the segment prefix.

Calculating SIZE= for HDAM Primary Data Set Group

The minimum block or control interval size that you can specify for the primary data set group of an HDAM database is dependent on whether or not the DBD statement rbn parameter of the RMNAME parameter is specified.

- If rbn is specified, then the following two conditions must be met:
  - size ≥ (RAPs*4) + FSEAP + 2 + VSAM CONTROL
  - size ≥ MAXSEG + FSEAP + VSAM CONTROL

- If rbn is not specified, then the following condition must be met:
  - size ≥ MAXSEG + (RAPs*4) + FSEAP + VSAM CONTROL

RAPs=
Number of root anchor points specified for the root addressable area of the database.

FSEAP=
4 bytes for a free space element anchor point.

VSAM CONTROL=
0 bytes for OSAM; 7 bytes for VSAM.

MAXSEG=
Length in bytes of the longest segment in this data set group including the segment prefix.

Calculating SIZE= for HDAM Secondary Data Set Groups

size ≥ MAXSEG + FSEAP + VSAM CONTROL

MAXSEG=
Length in bytes of the longest segment in this data set group including the segment.

FSEAP=
4 bytes for a free space element anchor point.

VSAM CONTROL=
0 bytes for OSAM; 7 bytes for VSAM.

Calculating SIZE= for HIDAM Data Set Groups

The minimum block or control interval size that you can specify for data set groups in a HIDAM database is dependent on the access method specified. The block or control interval size of the primary data set group is also dependent on the type of pointers specified for the root segment type.

If you specify forward-only hierarchic or physical twin pointers for the root segment type of a HIDAM database, the block or control interval size specified for the primary data set group must be:

size ≥ MAXSEG + FSEAP + RAP + VSAM CONTROL

Under any other conditions for primary or secondary data set groups, the block or control interval size specified must be:

size ≥ MAXSEG + FSEAP + VSAM CONTROL

MAXSEG=
Length in bytes of the longest segment in this data set group including the segment prefix.

FSEAP=
4 bytes for a free space element anchor point.

VSAM CONTROL=
0 bytes for OSAM; 7 bytes for VSAM.

RAP=
4 bytes for one root anchor point.

RECORD=(*reclen1,reclen2***)**

Specifies the data management logical record lengths to be used for this data set group. This parameter is optional and cannot be specified if ACCESS=LOGICAL is used on the DBD statement. reclen1 and reclen2 must be numeric values. The value of reclen2 must always be equal to or greater than the value of reclen1 except for GSAM databases. The meaning of each of the parameter's parameters depends on the type of database being defined as shown in Table 4 on page 37. For a simple HISAM database, the logical record length specified must be the same as the segment length specified. The minimum allowable logical record lengths for HISAM and INDEX DBDs are the same as the minimum block or control interval sizes described for the DATASET SIZE= parameter, except that VSAM CONTROL should be ignored. In addition, for both the VSAM KSDS and ESDS for HISAM, and INDEX DBDs, the logical record length specified must also be an even value. For VSAM primary index (INDEX, VSAM) databases, the overflow logical record length (reclen2) parameter should not be defined, because all index segments are inserted into the key sequence data set. For a GSAM database, reclen1 specifies the size of a logical record for a fixed-length record or the maximum size for a variable-length or undefined record. The value of reclen2 specifies the minimum size for a variable-length or undefined record.

RECFM=

Specifies the format of the records in the data set. The record format is specified using the characters defined as follows:

F The records are fixed-length.

FB The records are fixed-length and blocked.

V The records are variable-length.

VB The records are variable-length and blocked.

U The records are of undefined length.

This parameter is only valid for a GSAM database.

SCAN=*cyls*

Specifies the number of direct-access device cylinders to be scanned when searching for available storage space during segment insertion operations. This parameter is optional. It is only used when this DBD generation defines a HIDAM or HDAM database. If specified, *cyls* must be a decimal integer whose value does not exceed 255. Typical values are from 0 to 5. The default value is 3. If SCAN=0 is specified, only the current cylinder is scanned for space.

Scanning is performed in both directions from the current cylinder position. If a scan limit value causes scanning to include an area outside of the current extent, IMS adjusts the scan limits so that scanning does not exceed current extent boundaries. If space cannot be found for segment insertion within the cylinder bounds defined by this parameter, space is used at the current end of the data set group for the database.

FRSPC=

Specifies how free space is to be distributed in an HDAM or HIDAM database. The free block frequency factor (fbff) specifies that every nth control interval or block in this data set group is left as free space during database load or reorganization (where fbff=n). The range of fbff includes all integer values from 0 to 100 except fbff=1. The fspf is the free space percentage factor. It specifies the minimum percentage of each control interval or block that is to be left as free space in this data set group. The range of fspf is from 0 to 99. The default value for fbff and fspf is 0. If the total of the percentage of free space specified

and any segment size exceeds the control interval or block size, a warning message that flags oversized segments is issued by DBDGEN. When loading oversized segments, the “fspf” specification is ignored and one control interval or block is used to load each oversized segment.

When you specify the first parameter, FBFF, realize that a smaller value increases the frequency of free space in the database. A value of 2, for example, would mean that after every piece of data there would be a free space block. This causes system performance degradation when running reorganization or load utilities because of the extra processing required for the free space blocks.

SEARCHA=

Specifies the type of HD space search algorithm that IMS uses to insert a segment into an HD database.

0 Specifies that IMS chooses which HD space search algorithm to use. This is the default. For this release, IMS uses the same algorithm it would use if you had specified SEARCHA=2.

1 Specifies that IMS uses the HD space search algorithm that does not search for space in the second-most desirable block or CI.

2 Specifies that IMS uses the HD space search algorithm that includes a search for space in the second-most desirable block or CI.

Related Reading: Refer to *IMS Version 9: Administration Guide: Database Manager* for more information about the HD space search algorithm.

REL=

Defines whether an MSDB is a non-terminal-related (NO or TERM) or a terminal-related (FIXED and DYNAMIC) MSDB. There is no ownership of segments in non-terminal-related MSDBs.

MSDBs with terminal-related keys are not supported for ETO in IMS™ V5 or above. Other types of MSDBs are still supported.

With terminal-related MSDBs, each segment is assigned to a different LTERM. The LTERM name is the segment key but is not contained in the segment. Each LTERM owns no more than one segment per MSDB, and only the owner can alter a segment.

NO

Specifies a non-terminal-related MSDB without terminal-related keys. The key and the sequence field are part of the segment.

TERM

Specifies a non-terminal-related MSDB with terminal-related keys. The key is the LTERM name (not part of the segment) and there is no sequence field.

FIXED

Specifies a terminal-related fixed MSDB. The LTERM name is the segment key. Segment updates are allowed. Segment insertions and deletions are not allowed.

DYNAMIC

Specifies a terminal-related dynamic MSDB. The LTERM name is the segment key. Segments can be inserted and deleted. No more than one insertion or deletion can be made to the same MSDB from a single LTERM within one sync processing interval.

search field name
Specifies a 1- to 8-character alphanumeric name. The name must not be the same as any other field name defined in a FIELD statement.

Because a sequence field cannot be defined for an MSDB using an LTERM name as a segment key (REL=TERM, FIXED, or DYNAMIC), a search field name is provided to allow qualified calls. The only valid value in an SSA is an LTERM name. Therefore, the search field is treated as an 8-byte character field and no further definition is provided.

Data Sets in IMS Data Set Groups

The DD statements for non-HALDB data sets in each IMS database must be provided with each job that accesses the database. For databases used by message or batch message processing programs, you must include DD statements in the JCL for the IMS control region. For databases used exclusively in the batch processing environment, you must include DD statements in the JCL for the batch processing region. In a z/OS online environment, databases can be dynamically allocated.

DD statements are not required for HALDB data sets, because they are dynamically allocated.

DD Statements Required for VSAM

When the operating system access method for a database is VSAM, one DD statement is required for each KSDS and one for each ESDS. The parameters required on the DD statements have the following format:

```
//DDname    DD    DISP=SHR,DSNAME=
```

UNIT=, VOLSER=, and SPACE= parameters are not required because all VSAM data sets are cataloged.

For a HISAM database, two DD statements are required: one for the KSDS and one for the ESDS. If the HISAM database has only one segment type defined, only the KSDS DD statement is required.

For an HDAM or HIDAM database, one DD statement is required for each data set group. For the prime index of a HIDAM database one DD statement is required for the KSDS.

For secondary index databases with unique keys one DD statement is required for the KSDS.

For secondary index databases with nonunique keys, two DD statements are required; one for the KSDS and one for the ESDS. Note that secondary index databases with nonunique keys are not supported for HALDB. In addition to the DD statements defining VSAM data sets, a DD statement specifying a data set containing parameters defining the IMS VSAM buffer pool must be provided for batch regions. The DDNAME for this DD statement is DFSVSAMP. For online IMS execution, this information is provided in a member of the IMS.PROCLIB data set with member name DFSVSMxx.

Related Reading: Refer to *IMS Version 9: Installation Volume 2: System Definition and Tailoring* for more information on the IMS.PROCLIB data set.

DD Statements Required for OSAM

Related Reading: Refer to the *IMS Version 9: Customization Guide* for Operating system procedures for execution of all IMS region types. The appropriate DD statements must be appended to these procedures.

For HSAM, you must provide a DD statement for either input or output in the following format:

```
//DDname   DD  DSNAME= ,UNIT=    ,VOL=SER=   ,
//             DISP=  ,DCB=
```

Where the DD statement is for an HSAM output data set, the data set must be preallocated, or the SPACE= parameter must be present when a direct-access storage device is used.

RECFM=FB is optional, but if used, must be specified at load time. RECFM=F must not be specified.

For an OSAM data set, the LRECL, BLKSIZE, and BUFL subparameters of the DCB parameter should be omitted. This information is obtained from the DBD and cannot be overridden.

For HDAM or HIDAM, a DD statement is required for the OSAM data set of each data set group. The format is as follows:

```
//dd1      DD  DSNAME=         ,UNIT=      ,VOL=SER=   ,
//             DISP=       ,DCB=(DSORG=PS[,OPTCD=W])
```

When the HDAM or HIDAM database is being created, the OSAM data set must be preallocated, or the SPACE= parameter must be present.

If a model DSCB is to be used to describe a generation data set, the LRECL, RECFM, and BLKSIZE parameters must be omitted from the model DSCB. This information is obtained from the DBD and cannot be overridden.

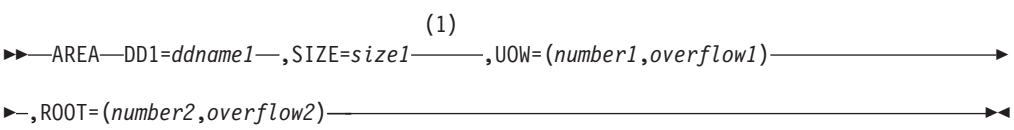
AREA Statement

Restriction: AREA statements are not allowed for HALDBs. Partitions are defined outside DBDGEN.

DEDB databases use an AREA statement to define an area within a database. In the DBDGEN input deck for a DEDB, all AREA statements must be placed between the DBD statement and the first SEGM statement. At least one AREA statement is required, but as many as 2048 AREA statements can be used to define multiple areas.

An example of the AREA statement follows. The parameters are explained in “AREA Statement Parameter Description” on page 45.

DEDB Database AREA Statement



Notes:

1 The valid parameter specifications for a DEDB SIZE keyword are 512 bytes, 1KB, 2KB, 4KB, 8KB and multiples of 4KB up to 28KB. To ensure future compatibility, use only C1 sizes that are multiples of 4KB.

AREA Statement Parameter Description

AREA
Identifies this statement as a DEDB AREA control statement.

DD1=
Specifies the ddname of the defined area. ddname1 must be a 1- to 8-character alphanumeric name. This parameter can be an area name or a ddname for single area data sets but can only be an area name for multiple area data sets. If the database is registered in DBRC, this parameter should specify the area name.

DEVICE=
Specifies the physical storage device type on which the data set in this area is stored. The default is 3380. If you code any other device, it will be ignored.

SIZE=
Specifies the control interval. Size can be 512 bytes, 1 KB, 2 KB, 4 KB, and 8 KB and multiples of 4 KB up to 28 KB. For future compatibility, only CI sizes that are multiples of 4 KB should be used. No default value is allowed.

Restriction: 4 KB cannot be specified with a 2319 device.

For DEDBs, the DBDGEN SIZE= must match the control interval size defined to VSAM, because IMS uses this value in accessing the data set. If the control interval size is changed in the VSAM data set, the DBD for that area must be changed to the new SIZE= value.

UOW=
Specifies the number of control intervals in a unit of work (UOW). The UOW= parameter has two operands, number1 and overflow1.

number1
Specifies the number of control intervals in a unit of work (UOW). Its value must be from 2 to 32767.

overflow1
Specifies the number of control intervals in the overflow section of a UOW. Overflow1 can be any value greater than or equal to one but at least one less than the specified value for number1.

The total number of root anchor points (RAPs) within one UOW is given by number1 minus overflow1. Multiply the number of RAPs in one UOW by the number of UOWs in the root addressable part to find the total number of RAPs within an area.

ROOT=
Specifies characteristics of a DEDB area. The ROOT= parameter has two operands, number2 and overflow2.

number2
Specifies the total space allocated to the root addressable part of the area and to the area reserved for independent overflow. It is expressed in UOWs. The rest of the VSAM data set is reserved for sequential dependent data. The value must be greater than 2 and less than 32767; it cannot be larger than the amount of space actually in the VSAM data set.

overflow2
Specifies the space reserved for independent overflow in terms of UOWs. It must be at least one and must be less than the value specified for number2. Although independent overflow does not contain UOWs, the UOW size is used as the unit for space allocation.

The reorganization UOW is automatically allocated by the DEDB Initialization utility. VSAM space definition should include this additional UOW. That is, the total space required is the root addressable area, the independent overflow, and one additional UOW for reorganization.

Example: This example allocates 2048*64*936 bytes and leaves the rest of the area for sequential dependent segments.

```
AREA DD1=XX,SIZE=2048,
     UOW=(64,14),
     ROOT=(936,36)
```

Because there is only one root anchor point (RAP) per control interval, the total number of RAPs within the area is given by: (64-14)*(936-36) = 45000 RAPs.

The amount of space allocated for independent overflow by DBDGEN can be increased while IMS is online.

Related Reading: Refer to *IMS Version 9: Administration Guide: Database Manager* for more information about this procedure.

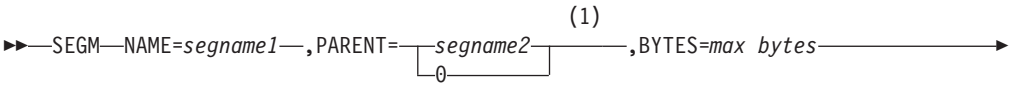
SEGM Statement

The SEGM statement defines a segment type, the segment's position in a database hierarchy, the physical characteristics of the segment, and how the segment is to be related to other segments. Except for GSAM databases, at least one SEGM statement must immediately follow each DATASET statement; the segment defined by the SEGM statement is placed in the data set group defined by the DATASET statement. Except for MSDBs and DEDBs, a maximum of 255 SEGM statements are allowed in a DBD generation. For a MSDB, only one SEGM statement can be specified. For a DEDB, at least one and up to 127 SEGM statements must immediately follow the last AREA statement; no other SEGM statements can be provided in the DBD generation. SEGM statements must be placed in the input file in hierarchic sequence, and a maximum of 15 hierarchic levels can be defined.

The SEGM statement is used with FIELD, XDFLD and LCHILD statements to totally define a segment to IMS. The FIELD statement defines fields within segments, the XDFLD statement defines fields used for secondary indexing, and the LCHILD statement defines index or logical relationships between segments.

The format of the SEGM statement for each database type is shown in the following examples. The parameters are explained in "SEGM Statement Parameter Description" on page 56.

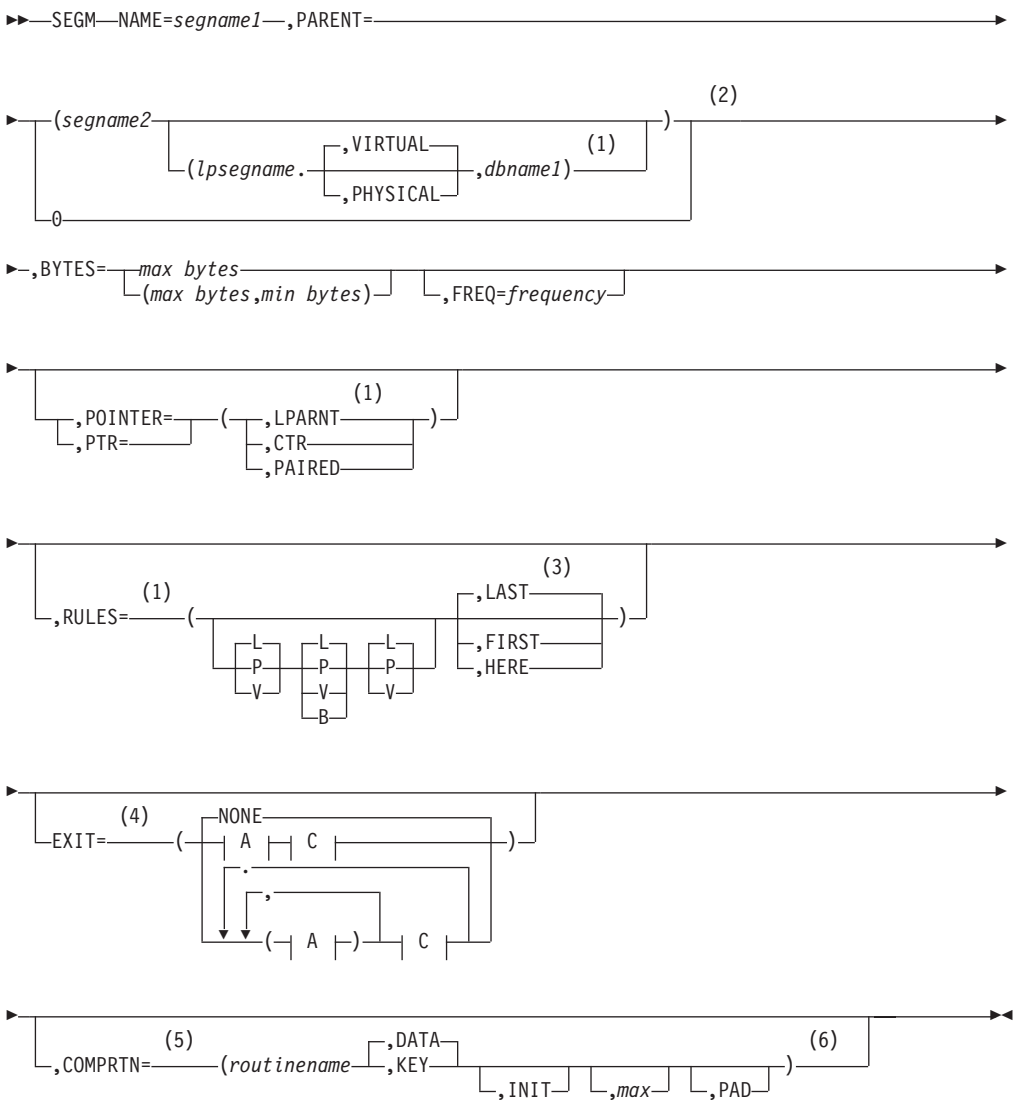
HSAM Database SEGM Statement



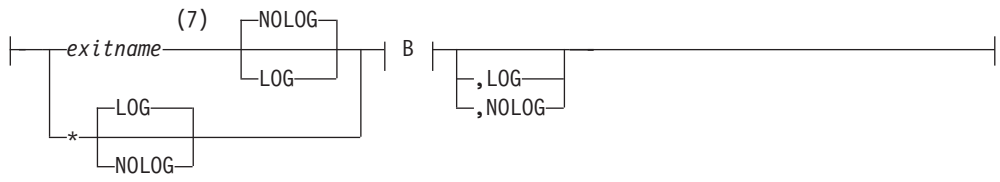
Notes:

1 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

HISAM Database SEGM Statement



A:



B:

C:

Notes:

1 Required for HISAM logical relationships; otherwise, it is optional.

2 The PARENT=keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

3 Required when a segment type does not have a unique sequence field. LAST is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden.

4 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

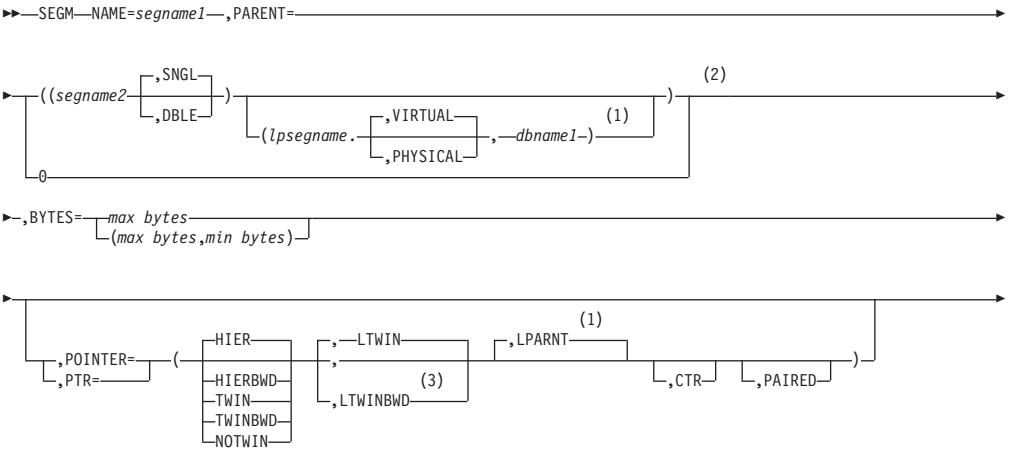
5 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

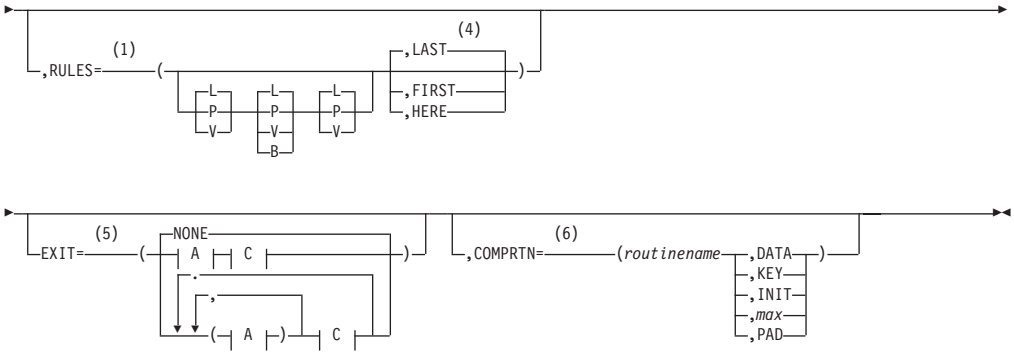
6 Variable-length segments and segment edit/compression cannot be specified for a simple HISAM database.

7 If an exit routine is not required because only logging is being requested, then if you specify the exit name as , the logging parameter defaults to LOG.

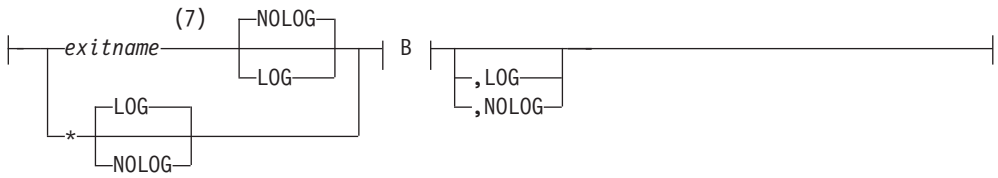
8 Used to control the CASCADE options.

HDAM Database SEGM Statement





A:



B:

C:

Notes:

1 Optional for HDAM logical relationships.

2 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

3 Required for HDAM logical relationships; otherwise, it is optional.

4 Required when a segment type does not have a unique sequence field. LAST is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden.

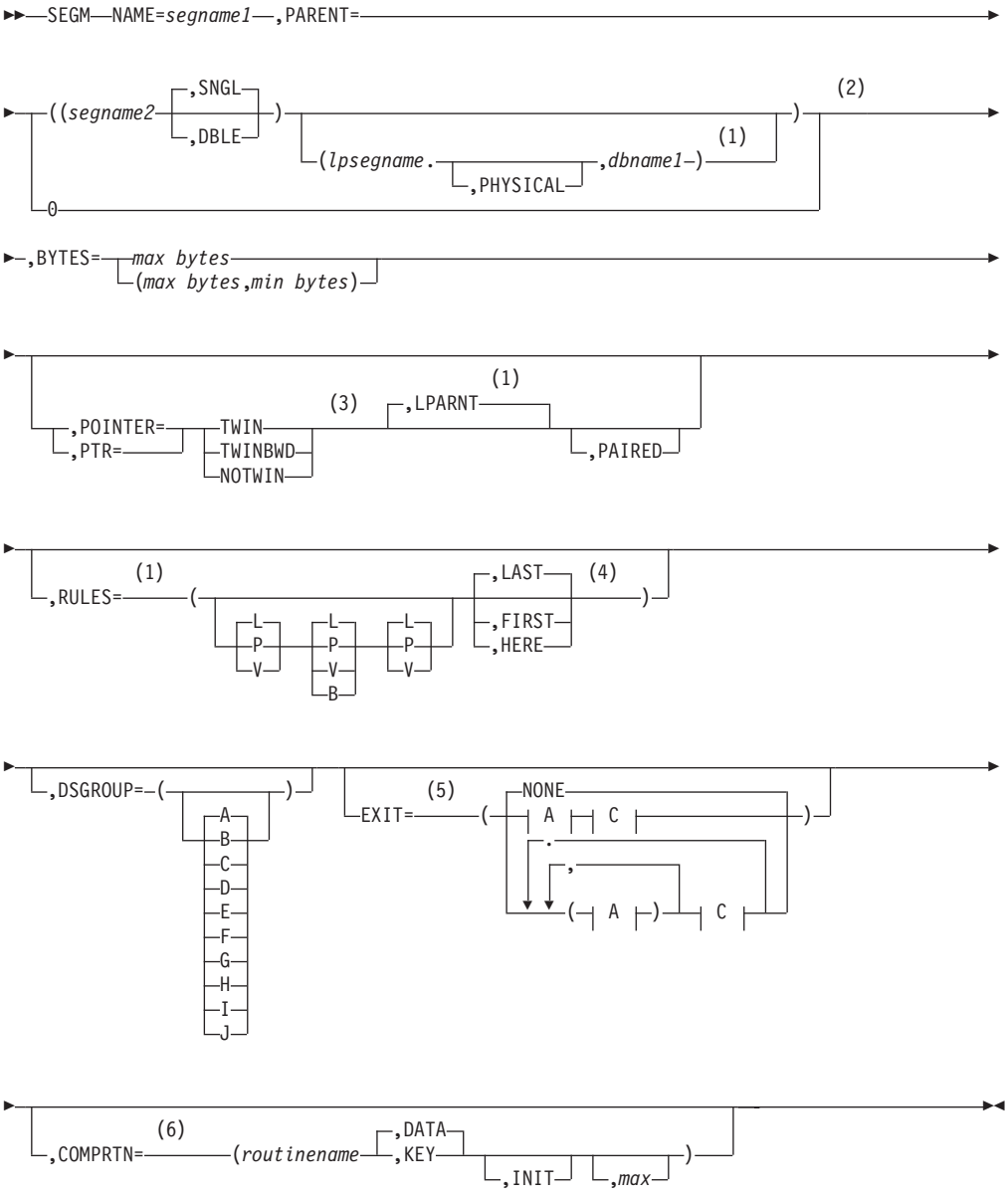
5 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

6 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

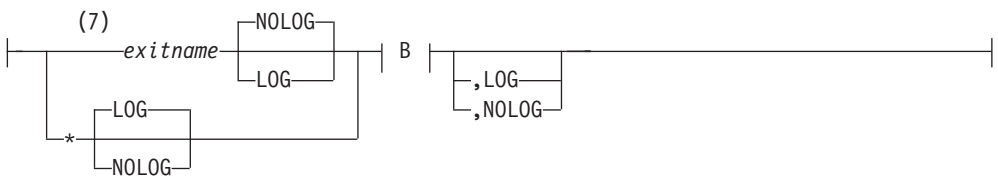
7 If an exit routine is not required because only logging is being requested, then if you specify the exit name as , the logging parameter defaults to LOG.

8 Used to control the CASCADE options.

PHDAM Database SEGM Statement



A:



B:

C:

Notes:

1 Optional for PHDAM logical relationships.

2 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

3 Required for PHDAM logical relationships; otherwise, it is optional.

4 Required when a segment type does not have a unique sequence field. LAST is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden.

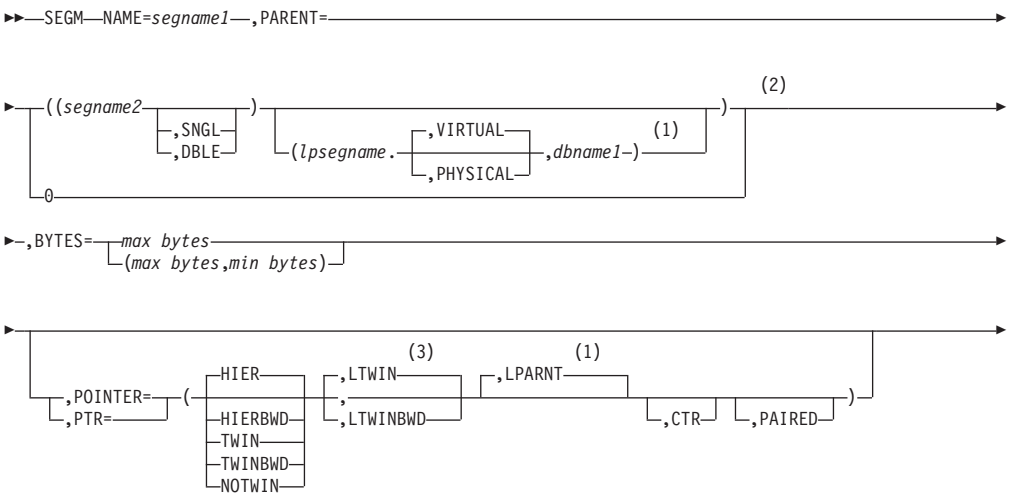
5 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

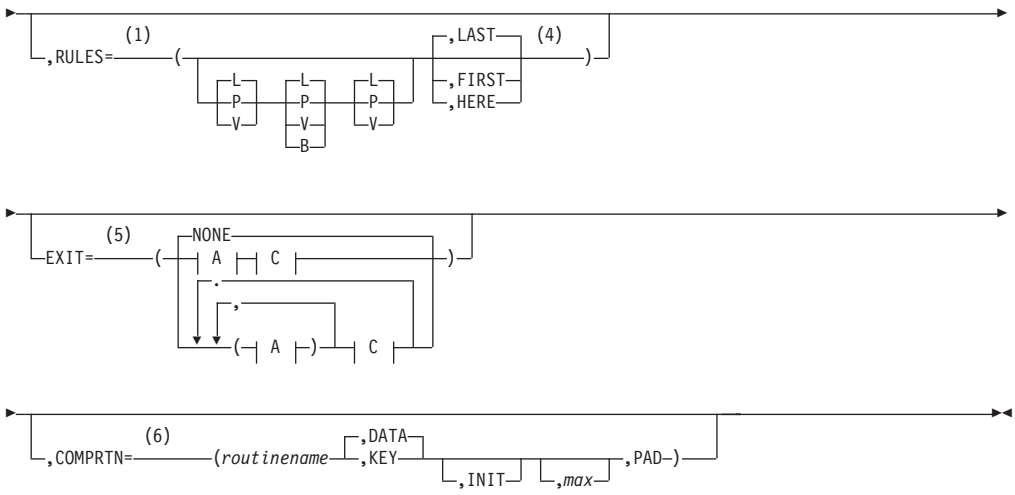
6 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

7 If an exit routine is not required because only logging is being requested, then if you specify the exit name as , the logging parameter defaults to LOG.

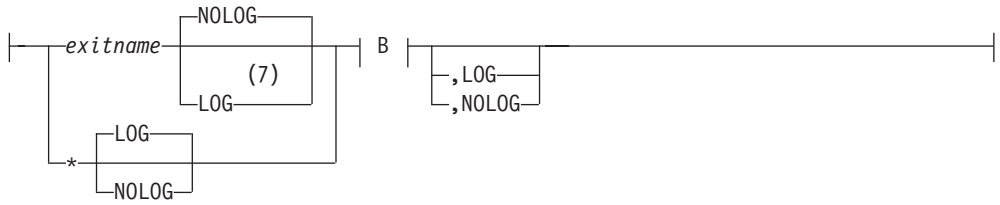
8 Used to control the CASCADE options.

HIDAM Database SEGM Statement





A:



B:

C:

Notes:

1 Optional for HIDAM logical relationships.

2 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

3 Required for HIDAM logical relationships; otherwise, it is optional.

4 Required when a segment type does not have a unique sequence field. LAST is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden.

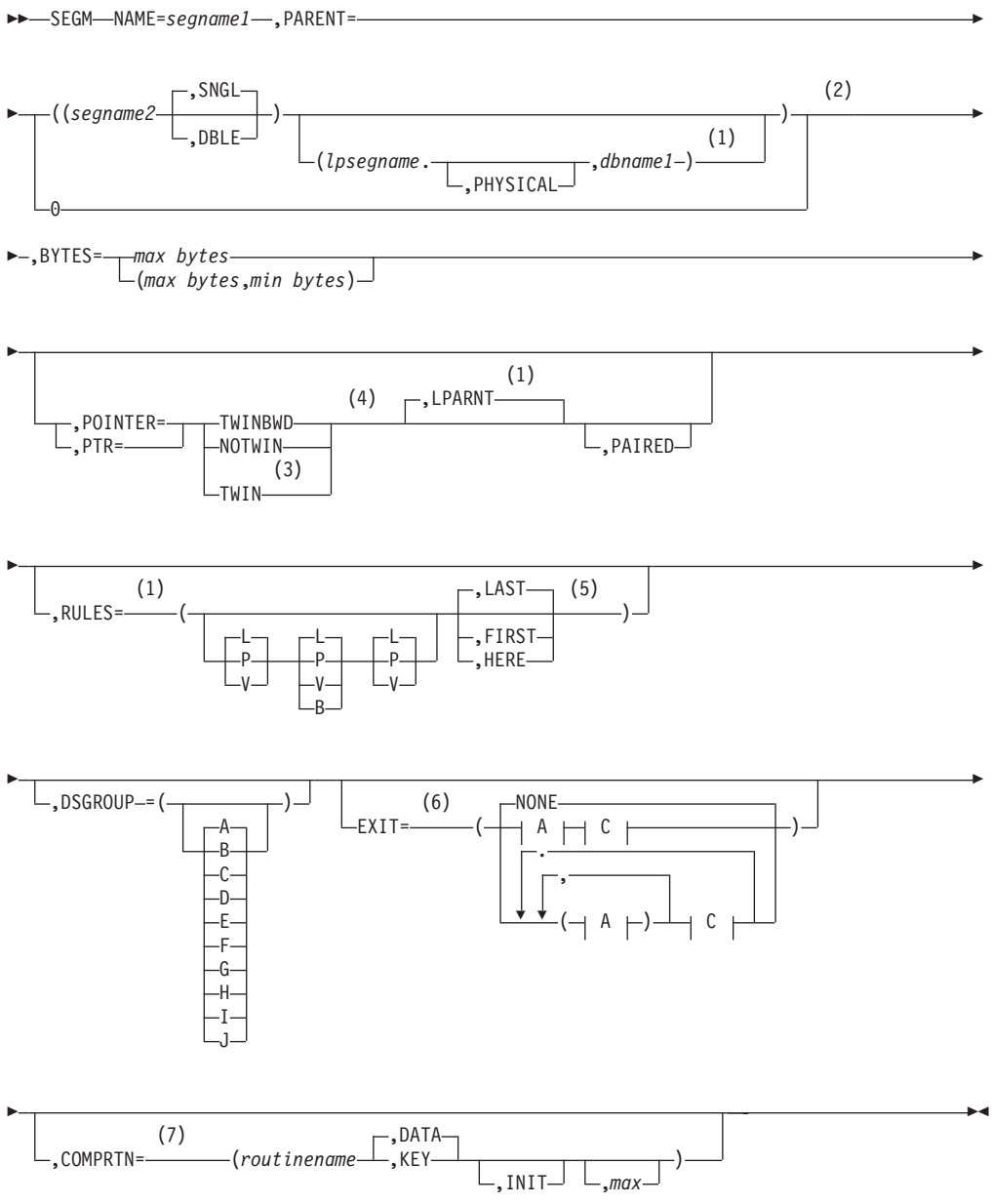
5 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

6 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

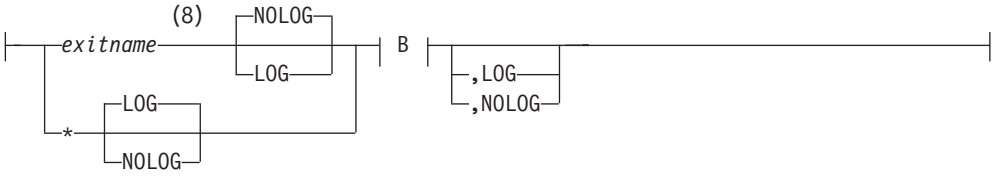
7 If an exit routine is not required because only logging is being requested, then if you specify the exit name as , the logging parameter defaults to LOG.

8 Used to control the CASCADE options.

PHIDAM Database SEGM Statement



A:



B:

C:

Notes:

1 Optional for PHIDAM logical relationships.

2 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

3 TWIN is not allowed for the root segment.

4 Required for PHIDAM logical relationships; otherwise, it is optional.

5 Required when a segment type does not have a unique sequence field. LAST is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden.

6 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

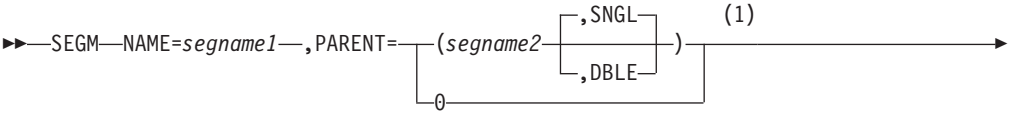
7 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

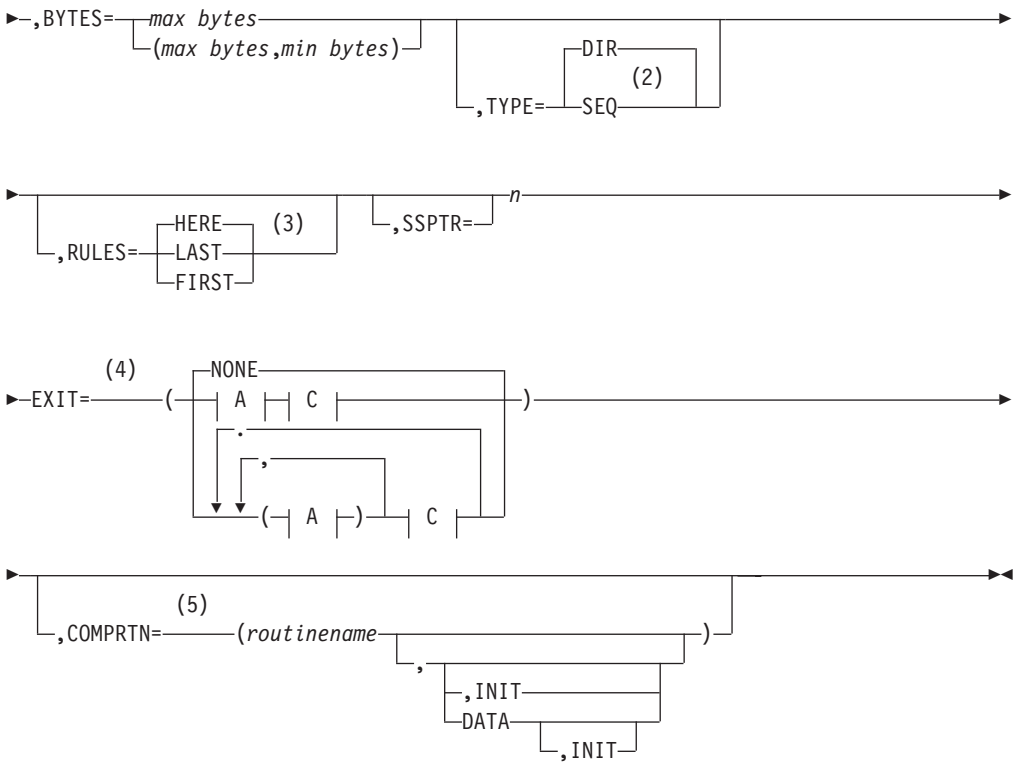
8 If an exit routine is not required because only logging is being requested, then if you specify the exit name as , the logging parameter defaults to LOG.

9 Used to control the CASCADE options.

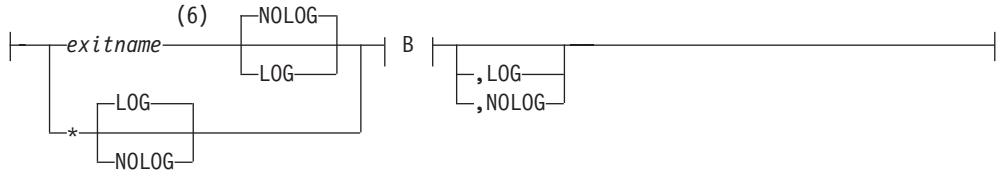
MSDB Database SEGM Statement

DEDB Database SEGM Statement





A:



B:

C:

Notes:

1 The PARENT= keyword can be omitted, or PARENT=0 can be specified for the root segment type of a database.

2 TYPE=SEQ is required on SEGM statements for the sequential dependent type.

3 Required when a segment type does not have a unique sequence field. HERE is the default. When using Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden. For DEDB direct dependent segment processing, HERE is the default.

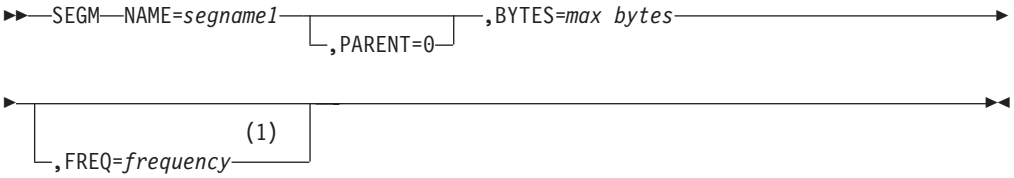
4 Used for the Data Capture exit routine. You can specify more than one exit routine on a SEGM statement.

5 Used for Segment Edit/Compression exit routine with full-function and DEDB databases.

6 If an exit routine is not required because only logging is being requested, specify the exit name as * and the default logging parameter is LOG. If you do specify an exit routine name, the default logging parameter is NOLOG.

7 Used to control the CASCADE options.

INDEX Database SEGM Statement



Notes:

1 FREQ= parameter will be ignored for PSINDEX

PSINDEX Database SEGM Statement

SEGM Statement Parameter Description

For the SEGM statement, you can use the following abbreviations in place of keywords specified in the macro definitions:

Keyword	Abbreviation
POINTER	PTR
FIRST	F
LAST	L
HERE	H
KEY	K
DATA	D
VIRTUAL	V
PHYSICAL	P

SEGM
Identifies this statement as a segment definition statement.

NAME=

Specifies the name of the segment type being defined. The specified name is used by DL/I and application programs in all references to this segment. Duplicate segment names are not allowed within a DBD generation. The *segname1* parameter must be a 1- to 8-character alphanumeric value. Each character must be in the range of A through Z, or 0 through 9, or be the character $, #, or @.

Restriction: The first character of the name cannot be numeric.

PARENT=

Specifies the names of the physical and logical parents of the segment type being defined, if any. Optional but must have a value of 0 if used.

BYTES=

Specifies the length of the data portion of a segment type in bytes using unsigned decimal integers. This parameter is required.

maxbytes and minbytes in fixed-length segments

For fixed-length segments, “maxbytes” specifies the amount of storage used for the data portion of the segment. The minbytes parameter cannot be specified for a fixed-length segment, including a fixed-length compressed segment. The maximum length specified for a segment type must not exceed the maximum record length of the storage device used minus any prefix or record overhead. For VSAM, the maximum record length is 30713 bytes; for tape, the maximum is 32760 bytes. The minimum length that can be specified for maxbytes must be large enough to contain all fields defined for the segment type. If the segment is a logical child segment type, the length must be sufficient to contain the concatenated key of the logical parent.

For a MSDB, the maxbytes value specifies the length of the data portion of a fixed-length segment not to exceed 32000 bytes. The value specified must be a multiple of 4.

maxbytes and minbytes in variable-length segments

Defines a segment type as variable-length if the minbytes parameter is included. The maxbytes field specifies the maximum length of any occurrence of this segment type. The maximum and minimum allowable values for the maxbytes parameter are the same values as described for a fixed-length segment.

The minbytes parameter specifies the minimum amount of storage used by a variable-length segment. The maximum value for minbytes is the value specified for maxbytes. The minimum value for minbytes must be:

- For a segment type that is not processed by an edit/compression routine or is processed by an edit/compression routine but the key compression option has not been specified, minbytes must be large enough to contain the complete sequence field if a sequence field has been specified for the segment type.
- For a segment type that is processed by an edit/compression routine that includes the key compression option or a segment that is not sequenced, the minimum value is 4.

Because segments in a HSAM or simple HISAM database cannot be variable-length, the minbytes parameter is invalid for these databases.

In a Fast Path DEDB, a segment starts with a 2-byte field, which defines the length of the segment including the 2-byte length field, followed by user

data specified by a FIELD statement. The value of minbytes can be specified from a minimum of 4 bytes to a maximum of maxbytes; however, the minbytes value must be large enough to contain this segment's sequence field (that is, minbytes ≥ START – 1 + BYTES of the sequence field following the SEGM statement). For example, the smallest minbyte value for a segment with a 20-byte sequence field length and START = 7 is 26. On any given DL/I call, the actual segment length can fall anywhere between a length that includes the sequence field and the value of maxbytes. The value of maxbytes must not exceed the control interval size minus 120.

TYPE=

Describes the type of DEDB dependent segment. Must not be specified for root segments.

SEQ

Specifies that the segment is a sequential dependent segment type. Only one sequential dependent segment is permitted per DEDB, and, if specified, it must be the first dependent segment type.

DIR

Specifies that the segment is direct dependent segment type. DIR is the default.

FREQ=

Is only used for HSAM, HISAM, or INDEX databases. It specifies the **estimated** number of times that this segment is likely to occur for **each** occurrence of its physical parent. The frequency parameter must be an unsigned decimal number in the range 0.01 to 2^{24}-1. If this is a root segment, "frequency" is the estimate of the maximum number of database records that appear in the database being defined. The value of the FREQ= parameter when applied to dependent segments is used to determine the logical record length and physical storage block sizes for each data set group of the database.

The IF0110 ARITHMETIC OVERFLOW or IEV103 MULTIPLICATION OVERFLOW assembler error message can occur when the DBDGEN utility is attempting to calculate a recommended logical record length. If this occurs during a HSAM or HISAM DBD generation, you may wish to determine the logical record length and physical block size.

POINTER=

Specifies the pointer fields to be reserved in the prefix area of occurrences of the segment type being defined. These fields are used to relate this segment to its immediate parent segments and twin segments.

The use of the POINTER= parameter is primarily for HDAM, HIDAM, PHDAM, and PHIDAM databases. In addition, it can be used for segment types defined in HISAM databases that participate in logical relationships with segment types in HDAM or HIDAM databases.

Important: If a segment type is being defined in an HSAM database, the POINTER= parameter must be omitted. If the segment type being defined is in a HISAM database and does not participate in a logical relationship, the POINTER= parameter should be omitted.

The following list describes some general attributes of the keyword options:

- Selected keyword options can be specified in any order, and must be separated by commas.
- A keyword option can be specified only once.
- All keywords are optional.

- One keyword option can be selected from each line.
- A keyword option or its abbreviation can be selected:

Table 5. POINTER= Keywords and Abbreviations

Keyword Option	Abbreviation
HIER	H
HIERBWD	HB
TWIN	T
TWINBWD	TB
NOTWIN	NT
LTWIN	LT
LTWINBWD	LTB
PAIRED	
LPARNT	LP
CTR	C

The keyword options of the POINTER= parameter have the following meanings:

HIER [H]
Reserves a 4-byte hierarchic forward pointer field in the prefix of occurrences of the segment type being defined. HALDB does not support HIER.

HIERBWD [HB]
Reserves a 4-byte hierarchic forward pointer field and a 4-byte hierarchic backward pointer field in the prefix of occurrences of the segment type being defined. Hierarchic backward pointers provide increased delete performance. HALDB does not support HIERBWD.

TWIN [T]
Reserves a 4-byte physical twin forward pointer field in the segment prefix being defined.

Related Reading: Refer to *IMS Version 9: Administration Guide: Database Manager* for a more detailed explanation of the use of PTR=TWIN in HIDAM database root segments.

TWINBWD [TB]
Reserves a 4-byte physical twin forward pointer field and a 4-byte physical twin backward pointer field in the segment prefix being defined. The twin backward pointers provide increased delete performance.

Recommendation: This option is recommended for HIDAM and PHIDAM database root segments.

Related Reading: For more information on pointer fields, see *IMS Version 9: Administration Guide: Database Manager*.

NOTWIN [NT]
Prevents space from being reserved for a physical twin forward pointer in the prefix of occurrences of the segment type being defined.

NOTWIN can be specified for a dependent segment type if:

- The physical parent does not have hierarchic pointers specified.

- No more than one occurrence of the dependent segment type is stored as a physical child of any occurrence of the physical parent segment type.

In addition, NOTWIN can be specified for the root segment type of HIDAM and PHIDAM databases, but only when the randomizing module does not produce synonyms (keys with different values having the same block and anchor point).

When NOTWIN is specified for a dependent segment type and an attempt is made to load or insert a second occurrence of the dependent segment as a physical child of a given physical parent segment:

- An LB status code is returned when trying to insert the second occurrence during initial load.
- An II status code is returned when trying to insert the second occurrence after initial load.

Any attempt to load or insert a synonym is rejected with an LB or II status code.

LTWIN [LT]
Is used for virtually paired logical relationships only when defining a real logical child. Reserves a 4-byte logical twin forward pointer field in the prefix of occurrences of the logical child segment type being defined. This parameter can only be specified if the segment type being defined is a logical child and is being defined in an HDAM or HIDAM database. It should be noted that if PAIRED is specified, the LTWIN parameter is invalid. HALDB does not support LTWIN.

LTWINBWD [LTB]
Is used for virtually paired logical relationships only when defining a real logical child. Reserves a 4-byte logical twin forward pointer field and a 4-byte logical twin backward field in the prefix of occurrences of the logical child segment type being defined. This parameter can only be specified if the segment being defined is a logical child and is being defined in an HDAM or HIDAM database. It should be noted that if PAIRED is specified, the LTWIN parameter is invalid. HALDB does not support LTWINBWD.

The use of LTWINBWD rather than LTWIN provides increased performance when deleting logical child segments.

LPARNT [LP]
Reserves a 4-byte logical parent pointer field in the prefix of occurrences of the segment type being defined. This parameter can only be specified when the segment type being defined is a logical child and the logical parent is in an HDAM or HIDAM database. If the logical parent is in a HISAM database, this parameter must be omitted, and the PARENT= parameter for the segment being defined must specify PHYSICAL.

CTR [C]
Reserves a 4-byte counter field in the prefix of occurrences of the segment type being defined. A counter is required if a logical parent segment in a HISAM, HDAM, or HIDAM database has logical child segments which are not connected to it by logical child pointers. Counters are placed in all segments requiring them automatically during DBD generation without the user specifying this parameter. To avoid a later DBD generation, however, the user can anticipate future requirements for counters and reserve a

counter field in the prefix of occurrences of a segment type by using this parameter. HALDB does not support CTR.

PAIRED

Indicates that this segment participates in a bidirectional logical relationship. This parameter is specified for the following types:

- A virtual logical child segment type
- Both physically paired logical child segment types in a bidirectional logical relationship

If PAIRED is specified, the LTWIN and LTWINBWD parameters are invalid.

POINTER= Parameter Default Values

The default option for the POINTER= parameter in any HIDAM or HDAM DBD is:

```
PTR=(TWIN,LTWIN,LPARNT)
```

LTWIN

Is a default if the name of a logical parent (lpsegname) is specified, in the PARENT= parameter of a SEGM statement.

LPARNT

Is a default if VIRTUAL is selected in the PARENT= parameter of a SEGM statement.

The default option for the POINTER= parameter in an INDEX, HISAM, or HSAM DBD is no pointer fields.

If the POINTER= parameter is explicitly stated on a SEGM statement, the segment contains the pointers specified and any pointers that are required by IMS for correct operation. For example, LTWIN and LPARNT pointers are created as required. The default values are only used when the parameter is omitted entirely. Table 6 illustrates use of the POINTER= parameter parameters for various types of DBD generations.

Table 6. Use of POINTER= Parameters (No Logical Relationship)

			Segment Definition				
			Physical Segments Contained in Database Type				
Purpose	**Keyword Parameter**	**Logical Segments GSAM MSDB DEDB**	**HSAM SHSAM SHISAM**	**HISAM**	**HDAM HIDAM**	**PHDAM PHIDAM**	**INDEX PSINDEX**
Pointer to next segment in hierarchy	HIER	INVALID	VALID	IGN	VALID	IGN	IGN
Pointer to next and previous segments in hierarchy	HIERBWD	INVALID	INVALID	IGN	VALID	IGN	IGN
Pointer to next occurrence of physical twins	TWIN	INVALID	INVALID	IGN	VALID	VALID	IGN
Pointer to next and previous occurrence of physical twins	TWINBWD	INVALID	INVALID	IGN	VALID	VALID	IGN
Counter field in prefix	CTR	INVALID	INVALID	VALID	VALID	IGN	IGN
Pointer to next occurrence of logical twin	LTWIN	INVALID	INVALID	IGN	VALID[1]	IGN	IGN
Pointer to next and previous occurrence of logical twins	LTWINBWD	INVALID	INVALID	IGN	VALID[1]	IGN	IGN
Pointer to logical parent segment	LPARNT	INVALID	INVALID	VALID[2]	VALID[3]	VALID[3]	IGN

Table 6. Use of POINTER= Parameters (No Logical Relationship) (continued)

			Segment Definition				
			Physical Segments Contained in Database Type				
Purpose	**Keyword Parameter**	**Logical Segments GSAM MSDB DEDB**	**HSAM SHSAM SHISAM**	**HISAM**	**HDAM HIDAM**	**PHDAM PHIDAM**	**INDEX PSINDEX**
Logical relationship between HS-HS or HS-HD or HD-HD	PAIRED	INVALID	INVALID	VALID[4]	VALID[5]	VALID[5]	IGN

Key:

- INVALID—This parameter cannot be specified.
- IGN—This parameter can be specified but it is ignored.
- VALID—This parameter is valid and used as indicated in the following notes.

Notes:

1. Used when a logical child segment being defined participates in a logical relationship. VALID should be specified if the segment exists within HDAM, PHDAM, HIDAM, or PHIDAM and the logical parent relates to the logical child with direct addresses (logical child pointers).
2. Can be used when a logical child segment is being defined in a HISAM database and the logical parent is defined in an HDAM, PHDAM, HIDAM, or PHIDAM database.
3. Can be used when a logical child segment is being defined in an HDAM, PHDAM, HIDAM or PHIDAM database and the logical parent is in an HDAM, PHDAM, HIDAM, or PHIDAM database.
4. Can be used when a logical child segment is being defined in a HISAM database and the logical parent is defined in a HISAM, HDAM, HIDAM, PHDAM, or PHIDAM database, and the logical relationship is bidirectional.
5. Used when a bidirectional logical relationship is being defined with two logical child segments, both physically present or on the SEGM statement for a virtual logical child.

RULES=

Specifies the rules used for insertion, deletion, and replacement of occurrences of the segment type being defined.

Related Reading: Refer to the “Replace, Insert, and Delete Rules for Logical Relationships” topic in the *IMS Version 9: Administration Guide: Database Manager* for a description of the various uses of this keyword.

path type values

Specifies the path type that must be used to insert, delete, or replace a segment.

The first column applies to segment insertion, the second column applies to segment deletion, and the third column applies to segment replacement. Each of the three columns can contain the same or different characters, but you must select a value from each column for a total of three values. These parameters are specified for logical child segments and for their physical and logical parent segments. They should be omitted for all segment types that do not participate in logical relationships. The values are: P specifies physical, L specifies logical, V specifies virtual, and B specifies bidirectional virtual.

FIRST or LAST or HERE

Specifies where new occurrences of the segment type defined by this SEGM statement are inserted into their physical database (establishes the physical twin sequence). This value is used only when processing segments with no sequence field or with a nonunique sequence field. The value is ignored when specified for a segment type with a unique sequence field defined.

Except for HDAM and PHDAM roots, the rules of FIRST, LAST, or HERE do not apply to the initial loading of a database and segments are loaded in the sequence presented in load mode. If a unique sequence field is not defined for the HDAM root on initial load or HD reload, the insert rules of FIRST, LAST, or HERE determine the sequence in which roots are chained.

Thus the reload of an HDAM or PHDAM database reverses the order of the unsequenced roots when HERE or FIRST is used.

In update mode, while processing HDAM and PHDAM roots without unique sequence fields, IMS sample randomizing modules (DFSHDC10 through DFSHDC40) use the segment I/O area data to calculate a block/rap for an insert call.

Related Reading: For more information about HDAM Randomizing Routines, see *IMS Version 9: Customization Guide*.

The rules of FIRST, LAST, or HERE are only valid for update mode after a database has been loaded, except for the HDAM and PHDAM exceptions noted in Table 6 on page 61. LAST is the default except for DEDB segments.

For Fast Path sequential dependent segment processing, the insert rule of FIRST is always used and cannot be overridden. For direct dependent segment processing, you can specify FIRST, LAST, or HERE. HERE is the default.

FIRST
For segments without a sequence field defined, a new occurrence is inserted before all existing physical twins. For segments with a nonunique sequence field defined, a new occurrence is inserted before all existing physical twins with the same sequence field value.

LAST
For segments without a sequence field defined, a new occurrence is inserted after all existing physical twins. For segments with a nonunique sequence field defined, a new occurrence is inserted after all existing physical twins with the same sequence field value.

HERE
For segments without a sequence field, a new occurrence is inserted immediately before the physical twin on which position was established. If a position was not established on a physical twin of the segment being inserted, the new occurrence is inserted before all existing physical twins. For segments with a nonunique sequence field defined, a new occurrence is inserted immediately before the physical twin with the same sequence field value on which position was established. If a position was not established on a physical twin with the same sequence field value, the new occurrence is inserted before all physical twins with the same sequence field value. The insert position is dependent on the position established by the previous DL/I call.

A command code of L (last) takes precedence over the insert rule specified causing a new occurrence to be inserted according to the insert rule of LAST, for insert calls issued against a physical path.

DSGROUP=
Specifies multiple data set groups for PHDAM and PHIDAM databases. The format is **DSGROUP=c**, where **c** is equivalent to the letters A through J. This enables you to divide PHDAM and PHIDAM databases into a maximum of ten data set groups. The default for every segment is A (single set for data per partition). If specified on the root segment, it must be DSGROUP=A.

Restriction: Gaps in the A-J sequence are not allowed. For example, if DSGROUP=C is specified on a SEGM statement, there must also be at least one SEGM statement with DSGROUP=B, and each HALDB partition will have A, B, and C data sets.

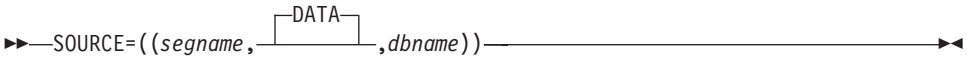
SOURCE=

Is used for two purposes:

- To identify the real logical child segment type that is to be represented by the virtual logical child segment type that is being defined
- To identify the segment type or types in physical databases that are represented by the segment type being defined in a logical database

Restriction: The SOURCE keyword is not allowed for PHDAM and PHIDAM databases because they support only physical pairing.

When defining a virtual logical child the statement is:

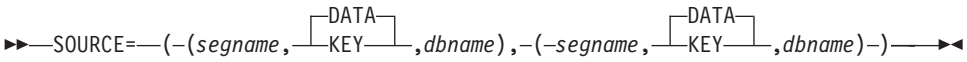


segname
Specifies the name of the real, logical child

DATA
Indicates that both the key and the data portions of *segname* are to be used in constructing the segment. This parameter is required.

dbname
Specifies the name of the physical database that contains the real logical child.

When defining a segment type in a logical database the statement is:



(*segname***, KEY|DATA,***dbname***)**
The first occurrence refers to the segment in a physical database that is being defined as a logical segment, or it refers to the logical child segment type in a physical database that is used for the first portion of a concatenated segment type in this logical database.

segname
Is the name of the segment type in the physical database.

KEY
Specifies that the key portion of the segment specified in *segname* is to be placed in the key feedback area. The segment must not be placed in the user I/O area when a call is issued to process the logical segment type that represents *segname*.

DATA
Specifies that the key portion of the segment specified in *segname* must be placed in the key feedback area, and the segment must be placed in the user I/O area when a call is issued to process the logical segment type that represents *segname*.

dbname
Specifies the name of the physical database that contains *segname*. The second occurrence of (*segname*, KEY|DATA, *dbname*) refers to the logical or physical parent segment type in a physical database that is used for the

destination parent part of a concatenated segment in this logical database. The description of each parameter for the second occurrence is the same as described for the first occurrence.

When the first occurrence of (*segname*, KEY/DATA, *dbname*) refers to a virtual logical child, the second occurrence, if specified, must refer to the real logical child's physical parent.

When the source segments is used to represent a concatenated segment, the KEY and DATA parameters are used to control which of the two segments (or both) are placed in the user's I/O area on retrieval calls. If DATA is specified, the segment is placed in the user's I/O area. If KEY is specified, the segment is not placed in the user's I/O area, but the sequence field key, if one exists, is placed in the key feedback area of the PCB. The key of a concatenated segment is the key of the logical child, either the physical twin sequence field or the logical twin sequence field, depending on which path the logical child is accessed from. The KEY and DATA parameters apply to retrieval type calls only.

On insert calls, the user's I/O area must always contain the logical child segment and, unless the insert rule is physical, the logical parent segment. Even if KEY is specified for a segment, the database containing that segment must be available to IMS when calls are issued against the logical database containing the referenced segment. When the first occurrence of the SOURCE= segment specification references a logical child, the second occurrence referencing the destination parent for the concatenated segment should also be specified. If not explicitly specified it is included with the KEY parameter by default when the blocks are built.

The segments defined with a logical DBD generation must gain their physical definition from segments previously defined in one or more physical DBD generations.

If the SEGM statement defines a segment in an INDEX data set, the SOURCE= parameter is invalid.

SSPTR=

Specifies the number of subset pointers. You can specify from 0 to 8. When you specify 0 or if SSPTR is not specified, you are not using a subset pointer.

EXIT=

Specifies that the Data Capture exit routine is used. You can specify multiple exit routine names on a single SEGM statement. You can select different data options for each exit routine. The order you list the exit routines within the parameter determines the order the exit routines are called.

When specified on the SEGM statement, the EXIT= parameter can either override the specification on the DBD or limit the parameter to specific segments. The EXIT= parameter applies only to the particular segments within the physical database specified. However, when applied to logical children segments, the exit routine must be specified on the real logical child, not the virtual logical child. The following physical databases are supported by this exit routine:

- HDAM
- HIDAM
- PHDAM
- PHIDAM
- HISAM

- SHISAM
- DEDB

If the exit routine is not specified for a supported database organization or a supported segment type, DBDGEN fails.

Related Reading: For more information about this exit routine, see *IMS Version 9: Administration Guide: Database Manager*.

The EXIT= parameter can also be specified on the DBD statement.

exit_name
Specifies the name of the exit routine that processes the data. This parameter is required. The name must follow standard naming conventions. A maximum of 8 alphanumeric characters is allowed. You can specify an asterisk (*) instead of an exit routine name to indicate that you want logging only. If this is done, the logging parameter default is LOG. If you do specify an exit routine, the logging parameter is NOLOG.

The following operands are optional.

NONE
Nullifies an exit routine specified on the DBD statement. It must be specified on the SEGM statement to indicate the DBD exit name does not apply to that specific segment.

EXIT=NONE explicitly nullifies the exit specified on the DBD for virtual logical children.

KEY
Specifies the exit routine is passed the physical concatenated key. This key identifies the physical segment updated by the application.

KEY is the default.

NOKEY
Specifies the physical concatenated key is not required for the exit routine.

NOKEY is optional.

DATA
Passes physical segment data to the Data Capture exit routine for updating. When DATA is specified and a Segment Edit/Compression exit routine is also being used, the data passed is expanded data.

DATA is the default.

NODATA
Can be specified when the exit routine does not require segment data. Use NODATA to avoid the overhead created from saving physical segment data.

NODATA is optional.

NOPATH
Indicates the exit routine does not require data from segments in the physical root's hierarchical path. NOPATH is an efficient way to avoid the processing time needed to retrieve path data.

NOPATH is the default.

PATH
Can be specified when the data from each segment in the physical root's

hierarchic path must be passed to the exit routine for an updated segment. Use PATH to allow an application to separately access several segments for insertion, replacement, or deletion.

You can use the PATH option when information from segments in the path is needed to compose the DB2 primary key. The DB2 primary key would then be used in a propagation request for a dependent segment update. Typically, you need this kind of segment information when the parent contains the key information and the dependent contains additional data that would not fit in the parent segment.

You can also use PATH when additional processing is necessary. It could be that you are not accessing several segments with one call; for example, you did not invoke the `D` command code. In this case, additional processing is necessary if the application is to access each segment with a separate call.

PATH is optional.

CASCADE
Indicates the exit routine is called when DL/I deletes this segment because the application deleted a parent segment. Using CASCADE ensures that data is captured for the defined segment.

Related Reading: For a detailed discussion of delete rules for the Data Capture exit routine, see *IMS Version 9: Administration Guide: Database Manager*.

CASCADE is the default.

The CASCADE parameter has three suboptions. These suboptions control the way data is passed to the exit routine. If you specify suboptions, you must enclose the CASCADE parameter and the suboptions within parentheses.

KEY
Passes the physical concatenated key to the exit routine. This key identifies the segment being deleted by a cascade delete.

KEY is the default.

NOKEY
Can be used when the exit routine does not require the physical concatenated key of the segment being deleted.

NOKEY is optional.

DATA
Passes segment data to the exit routine for a cascade delete. DATA also identifies the segment being deleted when the physical concatenated key is unable to do so.

DATA is the default.

NODATA
Can be specified when the exit routine does not require segment data. NODATA reduces the significant storage and performance requirements that result from saving physical segment data.

NODATA is optional.

NOPATH
Indicates the exit routine does not require segment data in the physical

root's hierarchical path. Use NOPATH to eliminate the substantial amount of path data needed for a cascade delete.

NOPATH is the default.

PATH
Can be specified to allow an application to separately access several segments for a cascade delete.

PATH is optional.

NOCASCADE
Indicates the exit routine is not called when DL/I deletes this segment. Cascade delete is not necessary when a segment without dependents is deleted.

NOCASCADE is optional.

LOG
Requests that the data capture control blocks and data be written to the IMS system log.

NOLOG
Indicates that no data capture control blocks or data is written to the IMS system log.

COMPRTN=
Selects a Segment Edit/Compression exit routine for either DEDB or full-function database.

For segment edit/compression of full-function database

Do not specify this keyword if the SOURCE keyword is used. The DL/I COMPRTN keyword is invalid during DBDGEN for MSDB, HSAM, simple HSAM, simple HISAM, INDEX, and logical databases. It is also invalid for logical child segments in any database. When used for a HISAM database, it must not change the sequence field offset for HISAM root segments. In addition, the minimum segment length that can be specified for a segment type where the segment edit/compression option is specified is 4 bytes.

Note: If you are using a segment edit/compression exit routine and defined your segments as variable-length, be aware that when a variable-length segment is compressed, it is padded with null bytes up to the minimum segment length that was defined in the DBD. Minimum segment length essentially overrides the compression; this enables you to provide additional space during load time for segments that are heavily compressed.

routinename
Specifies the name of the user-supplied edit/compression exit routine. This name must be a 1- to 8-character alphanumeric value and must not be the same as any other name in IMS.SDFSRESL.

DATA
Specifies that the indicated exit routine condenses or modifies data fields only. Sequence fields must not be modified, nor data fields that change the position of the sequence field in respect to the start of the segment. DATA is the default value if a compression routine is named but no parameter is selected.

KEY
Specifies that the exit routine can condense or modify any and all fields within the named segment. This parameter is invalid for the root segment of a HISAM database.

INIT
Indicates that initialization and termination processing control is required by the segment exit routine. When this parameter is specified, the edit/compression routine gains control after database open and after database close.

max
Specifies the maximum number of bytes by which fixed length segments can increase during compression exits. You can specify from 1 to 32,767 bytes. The default for *max* is 10.

PAD
Indicates that the numeric value supplied by MAX should be used for padding and not for MAX. The numeric range of 1 to 32767 indicates a size to which an inserted segment will be padded when the compression of that segment results in a length somewhat less than the PAD value.

For segment edit/compression of DEDB

routinename
Specifies the z/OS load module name of the user-supplied segment edit/compression exit routine.

Requirement: The routine name is required.

DATA
Specifies that only the user data part of the segment is compressed. DATA is the default.

Restriction: The KEY parameter is not supported for DEDB. If you specify the KEY parameter, an error message is issued and DBDGEN is terminated.

INIT
Allows the segment compression exit routine to gain control immediately after the first area in the database is opened and returns control immediately before the last area in the database is closed. As long as the segment length is within the values specified by DBDGEN, no errors occur while checking the field qualification for segment compression or expansion.

Note: The COMPRTN= keyword is prohibited on DEDB segments containing a unique key field located at the end of the segment. If you use COMPRTN= to process these types of segments, DBDGEN fails and message DGEN440 is issued.

Related Reading: See *IMS Version 9: Messages and Codes, Volume 1* for a description of the DFEN440 message.

LCHILD Statement

The LCHILD statement defines the following:

- A logical relationship between two segment types in a HISAM, HIDAM, HDAM, PHDAM or PHIDAM database or a logical relationship between a segment type in any two of these databases

- A primary HIDAM index or secondary index relationship between two segment types
- No LCHILD statement should be entered for the primary index of a PHIDAM database

Logical Relationships

Following any SEGM statement that defines a logical parent segment type in a DBDGEN input deck, there must be one LCHILD statement for each segment type that is a logical child of that logical parent, except for virtual logical child segment types. These LCHILD statements establish the relationships between the logical parent and its logical child segment types. The SOURCE= parameter of a SEGM statement that defines a virtual logical child segment type establishes the same relationship between a logical parent and a virtual logical child segment type.

HIDAM Primary Index Relationship

Two LCHILD statements are used to establish the index relationship required between the HIDAM primary index database and the root segment type of a HIDAM database.

Following the SEGM statement that defines the root segment type in a HIDAM database DBD generation, there must be an LCHILD statement that names the index pointer segment type in an index database. Following the SEGM statement that defines the index pointer segment type in a HIDAM Primary index database DBD generation, there must be an LCHILD statement that names the root segment type in a HIDAM database.

Secondary Index Relationships

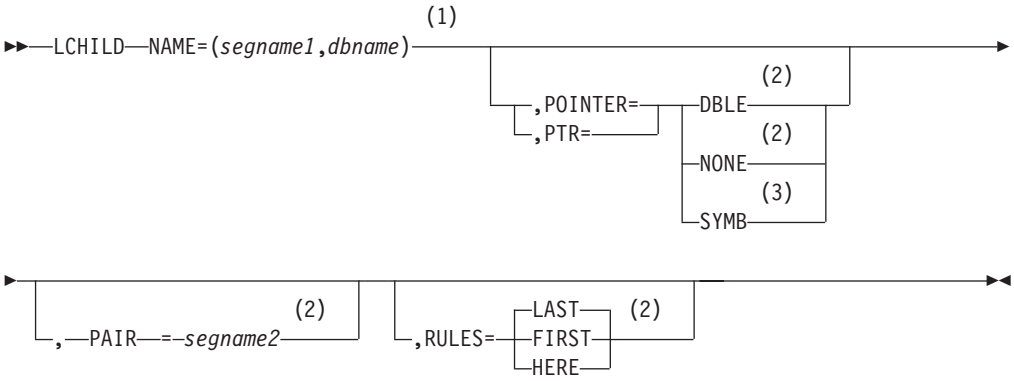
Two LCHILD statements are used to establish each secondary index relationship. Following a SEGM statement that defines an index target segment type, there must be one LCHILD statement for each index pointer segment type that points to that index target segment type. Each LCHILD statement following the SEGM for an index target segment type identifies the index pointer segment type that points to the index target.

Following a SEGM statement that defines an index pointer segment type in a secondary index database, there must be an LCHILD statement that identifies its index target segment type.

A maximum of 255 LCHILD statements can occur in a single DBD generation. An LCHILD statement can follow only a SEGM statement, FIELD statement, XDFLD statement, or another LCHILD statement. Because logical relationships and index relationships must not be defined in an HSAM database, LCHILD statements are invalid when ACCESS=HSAM.

The format of the LCHILD statement for each database type is shown in the following examples. The parameters are explained in “LCHILD Statement Parameter Description” on page 73.

HISAM Database LCHILD Statement



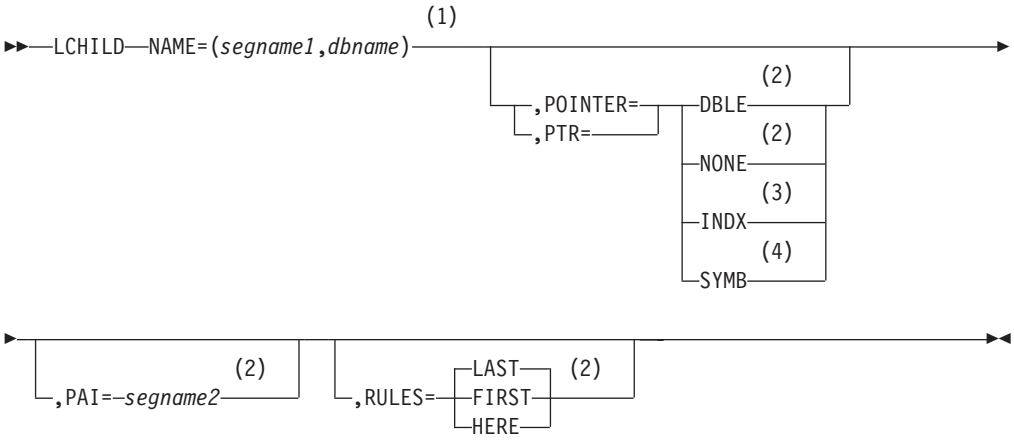
Notes:

1 Logical relationships or secondary indexing.

2 Used for HDAM, HISAM, and HIDAM logical relationships.

3 If symbolic pointing is specified for the index target segment type when defining its physical database, specify symbolic pointing in the secondary index for that segment type. If SYMB is specified for the target segment of a secondary index, the PTR=SYMB is specified on the LCHILD statement of the INDEX DBD also.

HDAM and PHDAM Database LCHILD Statements



Notes:

1 Logical relationships or secondary indexing.

2 Used for HDAM, HISAM, and HIDAM logical relationships.

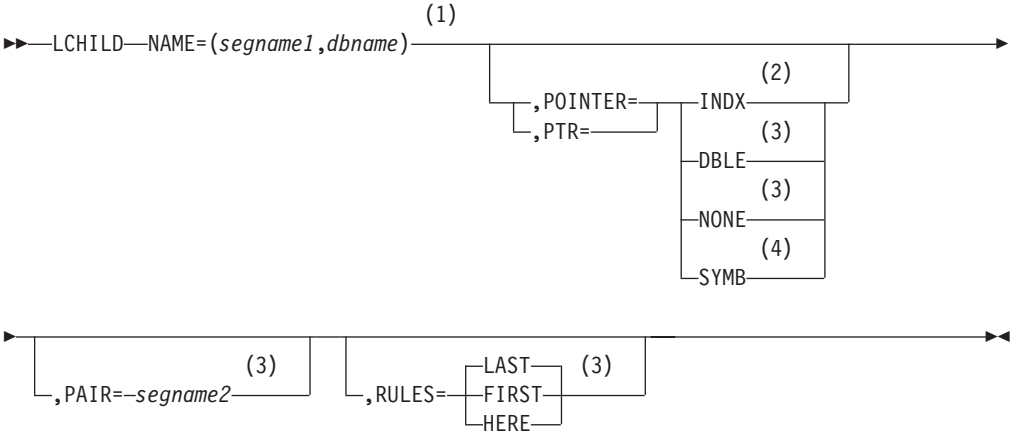
3 Required during a HIDAM DBD generation on the LCHILD statement that establishes the HIDAM Primary index relationship. If PTR=INDX is specified for the target segment of a secondary index, PTR must be omitted or specified as PTR=SNGL on the LCHILD statement of the INDEX DBD.

4 If symbolic pointing is specified for the index target segment type when defining its physical database, specify symbolic pointing in the secondary

index for that segment type. If SYMB is specified for the target segment of a secondary index, the PTR=SYMB is specified on the LCHILD statement of the INDEX DBD also.

HIDAM and PHIDAM Database LCHILD Statements

Restriction: Do not enter an LCHILD statement for the primary index of a PHIDAM database.



Notes:

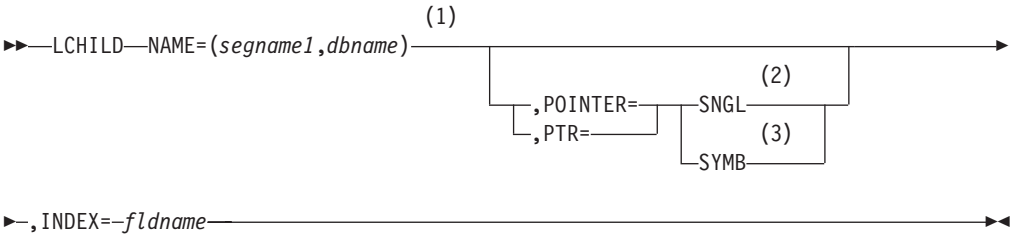
1 Logical relationships or secondary indexing.

2 Required during a HIDAM DBD generation on the LCHILD statement that establishes the HIDAM Primary index relationship. If PTR=INDX is specified for the target segment of a secondary index, PTR must be omitted or specified as PTR=SNGL on the LCHILD statement of the INDEX DBD.

3 Used for HDAM, HISAM, and HIDAM logical relationships.

4 If symbolic pointing is specified for the index target segment type when defining its physical database, specify symbolic pointing in the secondary index for that segment type. If SYMB is specified for the target segment of a secondary index, the PTR=SYMB is specified on the LCHILD statement of the INDEX DBD also.

INDEX Database LCHILD Statement



Notes:

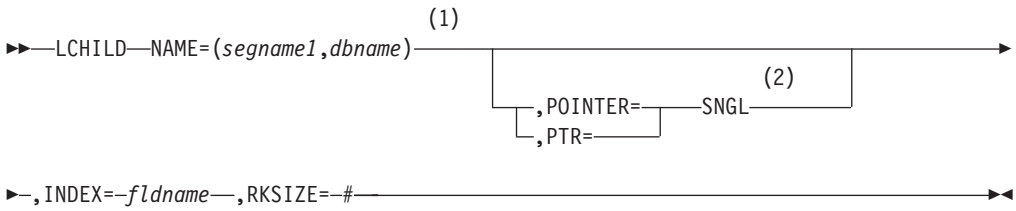
1 Logical relationships or secondary indexing.

2 Required for primary index of HIDAM database.

3 If symbolic pointing is specified for the index target segment type when

defining its physical database, specify symbolic pointing in the secondary index for that segment type. If SYMB is specified for the target segment of a secondary index, the PTR=SYMB is specified on the LCHILD statement of the INDEX DBD also.

PSINDEX Database LCHILD Statement



Notes:

1 Logical relationships or secondary indexing.

2 Required for primary index of HIDAM database.

LCHILD Statement Parameter Description

The following abbreviations can be used in place of keywords specified in the macro definition:

Keyword	Abbreviation
POINTER	PTR
FIRST	F
LAST	L
HERE	H

NAME=

The *segname1* parameter specifies the name of the logical child, index pointer, index target, HIDAM or PHIDAM root segment type that is to be associated with the segment type defined by the preceding SEGM statement in the DBD generation input deck. The *dbname* parameter is the name of the database that contains the segment type specified in *segname1*. *dbname* can be omitted when *segname1* is defined in this DBD generation. Both *segname1* and *dbname* must be 1- to 8-character alphanumeric values.

POINTER=

Specifies the pointers used in logical or index relationships. When the POINTER= keyword is omitted from any index DBD generation, POINTER=SNGL is the default. You must specify POINTER=INDX or SYMB for any LCHILD statement following an index target segment type; no default is provided for this part of the index relationship. When the POINTER= keyword is omitted from an LCHILD statement which establishes a unidirectional or physically paired bidirectional logical relationship, POINTER=NONE is the default. When the POINTER= keyword is omitted or specified as NONE for an LCHILD statement which establishes a virtually paired bidirectional logical relationship, POINTER=SNGL is the default.

Restriction: For PHDAM and PHIDAM databases, only the operands INDX and NONE are supported. All other operands are treated as if errors are present.

SNGL Is used for logical relationships, or index relationships implemented with direct address pointers. SNGL specifies that a logical child first pointer field is to be reserved in each occurrence of the segment type defined by the preceding SEGM statement in the DBDGEN input deck. When the preceding SEGM defines a logical parent, the pointer field contains a direct address pointer to the first occurrence of a logical child segment type. When the preceding SEGM defines the HIDAM Primary index database segment type, the pointer field contains a direct address pointer to a HIDAM database root segment. When the preceding SEGM defines an index pointer segment type in a secondary index database, the pointer field contains a direct address pointer to an index target segment.

DBLE Is used to specify two 4-byte pointer fields, logical child first and logical child last, reserved in the logical parent segment. The two pointers point to the first and last occurrences of logical child segment type under a logical parent. The logical child last pointer is of value when the logical child is not sequenced and the RULES= parameter is LAST.

NONE Should be used when the logical relationship from the logical parent to the logical child segment is not implemented or not implemented with direct address logical child pointers. In this case, the relationship from logical parent to logical child does not exist or is maintained by using physically paired segments. No pointer fields are reserved in the logical parent segment.

INDX Is specified on the LCHILD statement in a HIDAM database used to establish the index relationship between the HIDAM root segment type and the HIDAM Primary index during a HIDAM database DBD generation. INDX can also be specified on the LCHILD statement in the DBD for the target database that establishes the index relationship between an index target segment type and a secondary index. In these cases, omit the PTR= parameter or specify PTR=SNGL on the LCHILD statement of the primary or secondary index DBD. An LCHILD statement for a HIDAM primary index must precede the LCHILD statements for secondary indexes.

Note: If the target database is a HALDB, the index database must be defined as a HALDB index by use of the PSINDEX parameter in the DBD statement ACCESS parameter.

SYMB Can be used in the DBD generation for the target database of a secondary index to specify that the concatenated keys of the index target segments are to be placed in the index pointer segments in lieu of a direct pointer. You must specify SYMB when the index target segment type is in a HISAM database. SYMB is optional when the index target segment type is in an HDAM or HIDAM database.

An additional use of the SYMB parameter in the INDEX DBDGEN is to prevent reserving space in the prefix of index pointer segments for the 4-byte direct address index target segment pointer that is not used when the index pointer is symbolic.

PAIR=

Is specified *segname2* for bidirectional logical relationships only. The *segname2* parameter is the name of the logical child segment that is, physically or virtually, paired with the logical child segment specified in *segname1*. The *segname2* parameter must be a 1- to 8-character alphanumeric value.

Restriction: This parameter is not allowed for virtual pairing when using PHDAM and PHIDAM databases, because they only support physical pairing.

INDEX=
Is specified on LCHILD statements for an Index DBD generation only. The fldname parameter specifies the name of the sequence field of a HIDAM root segment type during DBD generation of the primary index for a HIDAM database, or the name of an indexed field, defined through an XDFLD statement in an index target segment type during DBD generation of a secondary index database.

Note: This parameter is not needed for a primary index of a PHIDAM database.

RKSIZE=
Specifies the root key size of the target segment.

Important: This parameter is required for partitioned secondary index (PSINDEX) databases only, and is invalid for any other database type.

RULES=
Is used for logical relationships when no sequence field or a nonunique sequence field has been defined for a virtual logical child. Under these conditions, the rule of FIRST, LAST, or HERE controls the sequence in which occurrences of the real logical child in the logical relationship are sequenced from the logical parent through logical child and logical twin pointers (this establishes the logical twin sequence).

Restriction: This parameter is not allowed for virtual pairing when using PHDAM and PHIDAM databases, because they only support physical pairing.

FIRST Indicates that, if no sequence field is specified for the logical child, a new occurrence is inserted before the first existing occurrence of the logical child. If a nonunique sequence field is specified for the logical child, a new occurrence is inserted before all existing occurrences with the same key.

LAST Indicates that, if no sequence field is specified for the logical child, a new occurrence is inserted after the last existing occurrence of the logical child. If a nonunique sequence field is specified for the logical child, a new occurrence is inserted after all existing occurrences with the same keys. LAST is the default option.

HERE Indicates that the insert is dependent on the position established by the previous DL/I call. If no sequence field is defined, the segment is inserted before the logical twin that position was established on through the previous call. If no position was established by a previous call, the new twin is inserted before all existing logical twins. If a nonunique sequence field is defined, the segment is inserted before the logical twin with the same sequence field value on which position was established by a previous call. If no position was established on a logical twin with the same sequence field value, the segment is inserted before all twins with the same sequence field value.

When a new occurrence of a logical child is inserted from its physical parent, no previous position exists for the logical child on its logical twin chain. Therefore, the new occurrence is placed before all existing occurrences on the logical twin chain when no sequence field has been defined, or before all existing occurrences with the same sequence field value when a nonunique sequence field has been defined.

A command code of L (last) takes precedence over the insert rule specified, causing a new occurrence to be inserted according to the insert rule of LAST, for insert calls issued against a logical path.

FIELD Statement

The FIELD statement defines a field within a segment type. Fields are referred to by PSBs when defining sensitivity to the fields or by an application program in a DL/I call segment search argument. A maximum of 1000 fields can be defined for all segments in a DBD generation, and a maximum of 255 fields can be defined for any segment type. A unique sequence field must be defined for the root segment types of HISAM, HIDAM, PHIDAM, HIDAM Primary INDEX, SHISAM, DEDB, and non-terminal-related MSDB databases. Root segment types in an HDAM database do not need a key field defined; if a key field is defined, it does not have to be unique.

The use of /SX to define unique secondary indexes in HDAM, HIDAM, PHDAM, and PHIDAM databases causes a 4-byte RBA of the index source segment to be included as part of the key of the index record. The use of /CK to define unique secondary indexes in HISAM, HDAM, HIDAM, PHDAM, and PHIDAM databases does the same. In a PSINDEX, the /SX specification causes an 8-byte ILK to be used instead of a 4-byte RBA.

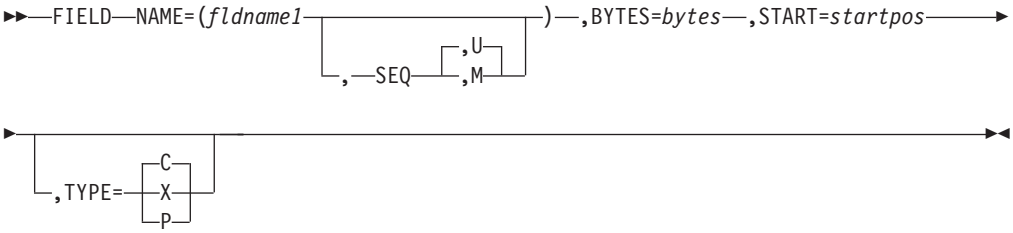
PSINDEX entries will also contain the root key of the target segment.

FIELD statements are used in DBD generation:

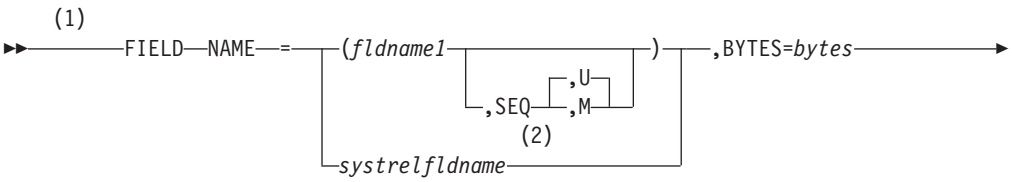
- To define fields of a segment type as that segment type is seen when it is accessed from its physical parent segment.
- To define the fields of a real logical child segment type in a virtually paired logical relationship as seen when that segment type is accessed from its logical parent. The FIELD statements must immediately follow the SEGM statement defining the virtual logical child.
- To define system-related fields that are used for secondary indexing.

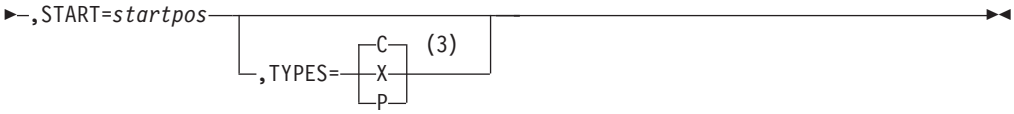
The format of the FIELD statement is for each database type is shown in the following examples. The parameters are explained in “FIELD Statement Parameter Description” on page 78.

HSAM Database FIELD Statement



HISAM Database FIELD Statement





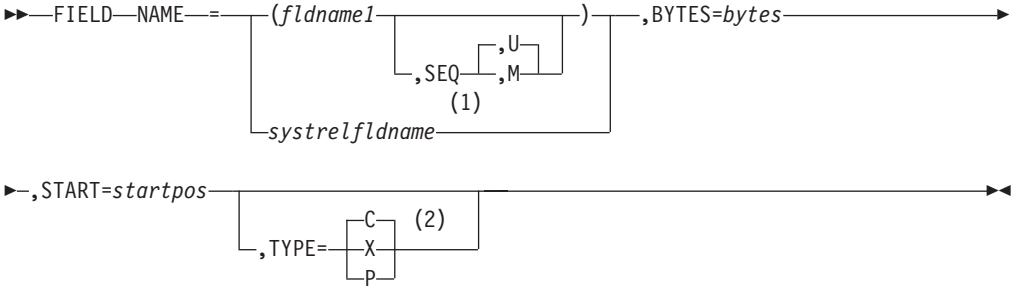
Notes:

1 Only CK can be coded for the systrelfldname field.

2 A system related field used for secondary indexing.

3 The TYPE=parameter is ignored for fields with a systrelfldname.

HDAM and PHDAM Database FIELD Statement

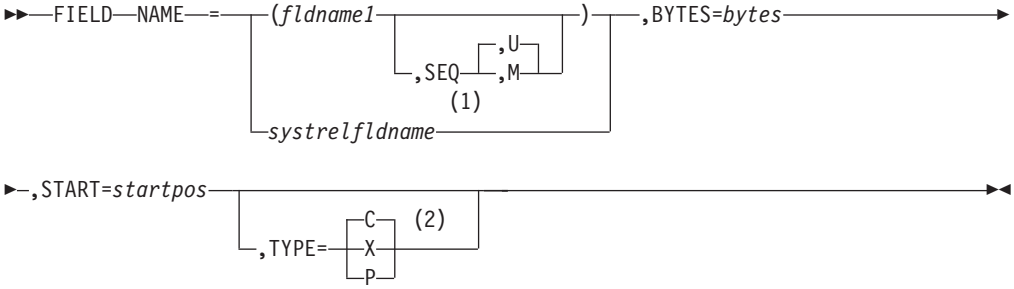


Notes:

1 A system related field used for secondary indexing.

2 The TYPE=parameter is ignored for fields with a systrelfldname.

HIDAM and PHIDAM Database FIELD Statements

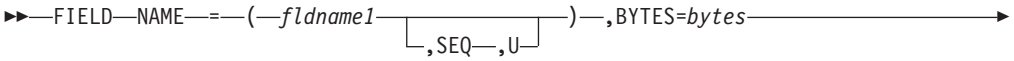


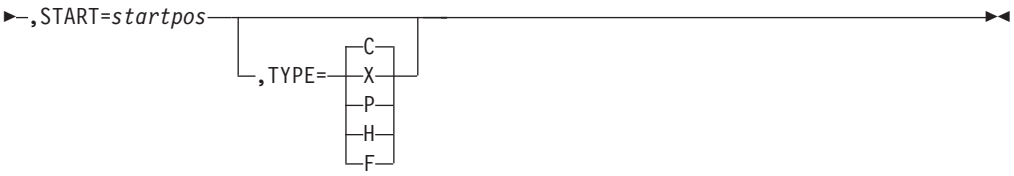
Notes:

1 A system related field used for secondary indexing.

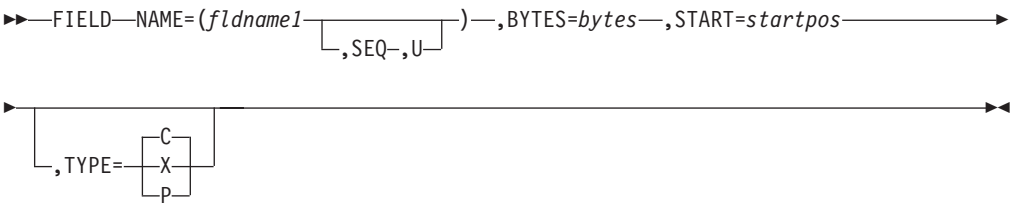
2 The TYPE=parameter is ignored for fields with a systrelfldname.

MSDB Database FIELD Statement

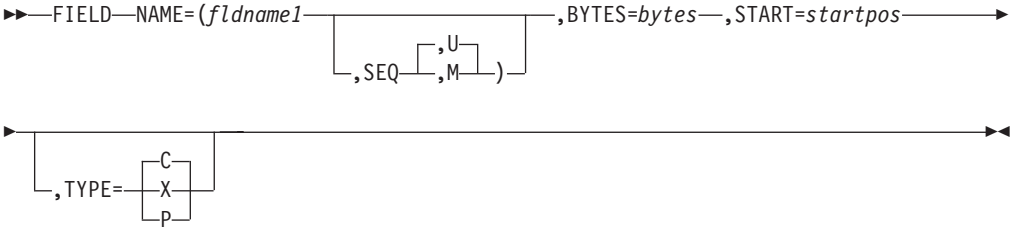




DEDB Database FIELD Statement



Index Database FIELD Statement



FIELD Statement Parameter Description

NAME=*fldname1*

Specifies the name of the field being defined within a segment type. The name specified can be referred to by an application program in a DL/I call SSA. Duplicate field names must not be defined for the same segment type. fldname1 must be a 1- to 8-character alphanumeric value.

SEQ

Identifies this field as a sequence field in the segment type. FIELD statements containing the keyword SEQ must be the first FIELD statements following a SEGM statement in a DBD generation input deck. If the sequence field of a real logical child segment consists of any part of the logical parent's concatenated key, you must specify the PHYSICAL parameter in the SEGM statement in order for the logical child to include the concatenated key of the logical parent with the logical child in storage.

As a general rule, a segment can have only one sequence field. However, in the case of virtually paired bidirectional logical relationships, multiple FIELD statements can be used to define a logical sequence field for the virtual logical child segment type, as described as follows.

A sequence field must be specified for a virtual logical child segment type if, when accessing a logical child segment from its logical parent, one requires real logical child segments to be retrieved in an order determined by data in a field or fields of the real logical child segments. This sequence field can include any part of the segment as it appears when viewed from the logical parent (that is, the concatenated key of the real logical child's physical parent followed by any

intersection data). Since it might be necessary to describe the sequence field of a logical child segment as accessed from its logical parent segment in noncontiguous pieces, multiple FIELD statements with the SEQ parameter present are permitted. Each statement must contain a unique *fldname1* parameter.

You can define any sequence field as a qualification in an SSA, but all succeeding sequence fields are considered as a part of the named field. Therefore, the length of the field named in the SSA is the concatenated length of the specified field plus all succeeding sequence fields. This “scattered” sequence field is permitted only when specifying the sequence field for a virtual logical child segment. If the first sequence field is not included in a “scattered” sequence field in an SSA, DL/I treats the argument as a data field specification rather than a sequence field specification. DL/I must examine all segment instances on a twin chain when a data field specification is evaluated. When a sequence field specification is evaluated the search continues along the twin chain until a sequence field value that is higher than the SSA value is reached. The search stops at that point.

In a MSDB, the keyword SEQ must be specified if the DATASET statement specifies REL=NO (a non-terminal-related MSDB without terminal-related keys); otherwise this keyword is invalid.

In a DEDB, SEQ must be used in the root segment and can be specified in any direct dependent segment.

Restriction: SEQ cannot be specified for the sequential dependent segment.

U or M

Qualifies the type of sequence (SEQ) field being specified. The parameter U indicates that only unique values are allowed in the sequence field of occurrences of the segment type. For a dependent segment type, the sequence field of each occurrence under a given physical parent segment must contain a unique value. The parameter M indicates that duplicate values are allowed in the sequence field of occurrences of the segment type. For a root segment type, the sequence field of each occurrence must contain a unique value, except in HDAM. The root segment type in an HDAM database does not need a key field; if a key field is defined, it does not have to be unique.

When no sequence field or a nonunique sequence field is defined for a segment, occurrences of the segment are inserted according to the rule of FIRST, LAST, or HERE as specified on the SEGM or LCHILD statement for that segment.

Recommendation: It is highly recommended that all segments which participate in a logical relationship have unique sequence fields. This includes physical and logical parents as well as physical and logical child segments. Multiple sequence fields for a virtual logical child segment type must be uniformly defined as either unique or nonunique.

In a non-terminal-related MSDB without terminal-related keys, unique (U) values must be specified for the root sequence field. In a DEDB, unique (U) values must be specified for the sequence field of the root segment. A dependent segment in a DEDB does not require a key. However, if a key is defined, it must be unique.

systrelfldname

Defines a system related field which can only be used for secondary indexing. There are two types of system-related fields:

- All of or a portion of the concatenated key of an index source segment type defined by the preceding SEGM statement. The name for this type of system-related field can be up to 8 characters long, and must begin with the three characters /CK. The fourth through eighth characters permit unique identification of the field being defined, whose name must be unique among all other fields defined in the segment type. This type of system-related field is defined to enable the use of the concatenated key of an index source segment, or portions of the concatenated key in the subsequence or duplicate data fields of index pointer segments.

  Example: Assume the concatenated key shown in Table 7:

Table 7. Sample Concatenated Key for an Index Source Segment Type

Root key (10 bytes)	Dependent key (3 bytes)	Dependent key (3 bytes)	Dependent key (3 bytes)

If three system-related fields were to consist of bytes 2 through 8 of the root key, byte 1 of the second key and bytes 5 and 6 of the fourth key, the FIELD statements specifying these fields could be as follows:

```
NAME=/CK1
BYTES=7
START=2

NAME=/CK2
BYTES=1
START=11

NAME=/CK3
BYTES=2
START=25
```

You can then specify the three system-related fields defined for use in the subsequence or duplicate data fields of index pointer segments by including the names of the system related fields in lists for the subsequence or duplicate data fields on an XDFLD statement.

- The second type of system-related field is defined within an index source segment type to ensure uniqueness of sequence field keys in a secondary index. The name specified for this type of system-related field must begin with the characters /SX, and the name specified can be up to 8 characters in length. When this type of system-related field is defined in an index source segment type, IMS generates a unique 4-byte value, and places it in the subsequence field of the index pointer segment generated from an index source segment.

On an XDFLD statement, a /CK field can be included in the list of fields specified for either the subsequence or DDATA fields or both of an index pointer segment. A /SX field can only be included in the list of fields specified for the subsequence field of index pointer segments.

BYTES=

Specifies the length of the field being defined in bytes. For fields other than system-related fields, BYTES must be a valid self-defining term whose value does not exceed 255. If a concatenated key or a portion of a concatenated key of an index source segment type is defined as a system-related field, the value specified can be greater than 255, but must not exceed the length of the concatenated key of the index source segment. The length of a /SX system-related field is always 4 bytes; therefore, when specified, the BYTES parameter is disregarded. For the sequence field of a MSDB segment, BYTES must not exceed 240. For the sequence field of a DEDB segment, BYTES must not exceed the value of minbytes specified for the segment.

START=

Specifies the starting position (startpos) of the field being defined in terms of bytes relative to the beginning of the segment. Startpos must be a numeric term whose value does not exceed 32767. Startpos for the first byte of a segment is one. For variable-length segments, the first 2 bytes contain the length of the segment. Therefore the first actual user data field starts in byte 3. Overlapping fields are permitted. When a SEGM statement defines a logical child segment, the first n bytes of the segment type is the logical or physical parent's concatenated key. A field starting in position one would define all or a portion of this field. A field starting in position n+1 would start with intersection data.

START= can be used for a system-related field, to describe a portion of the concatenated key as a field in an index source segment type. If used in this way, START= specifies the starting position of the relevant portion of the concatenated key relative to the beginning of the concatenated key. The first byte of the concatenated key is considered to have a position of one. It must be a numeric term whose value does not exceed the length of the concatenated key plus one. Subtract the value specified in the BYTES parameter. The startpos parameter for the /SX system-related field is disregarded.

TYPE=

Specifies the type of data that is to be contained in this field. The value of the parameter specified for this parameter indicates that one of the following types of data is contained in this field:

X Hexadecimal data

P Packed decimal data

C Alphanumeric data or a combination of types of data

F Binary fullword data

H Binary halfword data

Parameters F and H are valid only for MSDB databases.

All DL/I calls perform field comparisons on a byte-by-byte binary basis. No check is made by IMS to ensure that the data contained within a field is of the type specified by this parameter, except when the defined field is used with field sensitivity or is in an MSDB.

Types X, C, P, H, and F are valid in an MSDB, with the following rules applying:

- Only a C or X field can contain another field.
- A single field can have multiple definitions as long as no more than one definition is arithmetic (types P, H, and F).
- If a field contains any part of an arithmetic field, it must contain the entire field.
- The sequence field must be TYPE=C or X.
- The sequence field cannot be part of any other field.
- SSA and FSA comparisons of arithmetic fields use arithmetic rather than logical compare operations.
- Initial loading and call processing routines test for valid digits and X and P type fields.
- The following rules apply to the MSDB field length:
  - TYPE=X: BYTES=1 to 256
  - TYPE=P: BYTES=1 to 16
  - TYPE=C: BYTES=1 to 256

  - TYPE=F: BYTES=4
  - TYPE=H: BYTES=2
  - Field types F and H must have explicit length specifications.
  - Fields should be aligned on appropriate boundaries for performance optimization if they are involved in compare or arithmetic operations and are a fullword or halfword long. The beginning of the segment is aligned on a fullword boundary.
- If the systrelfldname in the field statement is defined as either /SX or /CK, the TYPE= parameter is ignored and no type is set.

When sensitivity to a field has been defined, the field is filled with a value under these conditions:

- When the application program is not sensitive to this field on an insert call
- When:
  - The application program replaces a variable-length segment with a segment that is longer than the existing segment
  - This field is in the added portion of the segment
  - The application program is not sensitive to this field
- When the application program retrieves a variable-length segment that does not contain this field

The TYPE parameter determines the value to be used, as follows:

TYPE	Value Used
X	Binary zeros
P	Packed decimal zero
C	Blanks

If an alphanumeric field (TYPE=C) is partially present in the physical segment, the data is moved to the field in the user's I/O area and padded on the right with blanks. Partially present hexadecimal or packed decimal fields are replaced with the fill value when presented to the user.

XDFLD Statement

Use the XDFLD statement only for secondary index relationships. Its purpose is to define the name of an indexed field that is associated to an index target segment type, identify the index source segment type, and identify the index source segment fields that are used in creating a secondary index. In addition, information regarding suppressing the creation of index pointer segments is provided through this statement.

Restriction: This statement cannot be used to reference a segment in a DBD where ACCESS=INDEX, SHSAM, SHISAM, HSAM, MSDB, or DEDB has been specified.

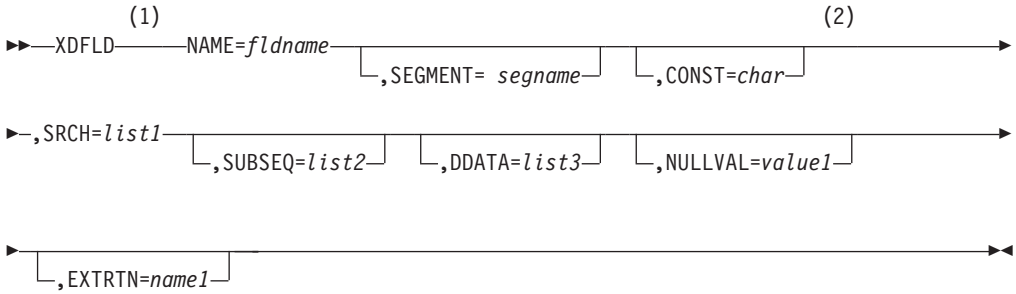
A maximum of 32 XDFLD statements are allowed per SEGM statement. The number of XDFLD and FIELD statements combined must not exceed 255 per SEGM statement, and must not exceed 1000 per DBD generation.

One XDFLD statement is required for each secondary index relationship. It must appear in the DBD generation input deck for the indexed database after the LCHILD statement that references the index pointer segment. Only FIELD

statements for the index target segment can appear between the LCHILD statement and the associated XDFLD statement in the input deck. The index target segment, which is the segment defined by the preceding SEGM statement in the DBD generation input deck must not be either a logical child segment type or a dependent of a logical child segment type.

The format of the XDFLD statement is for each database type is shown in the following examples. The parameters are explained in “XDFLD Statement Parameter Description” on page 84.

HISAM Database XDFLD Statement

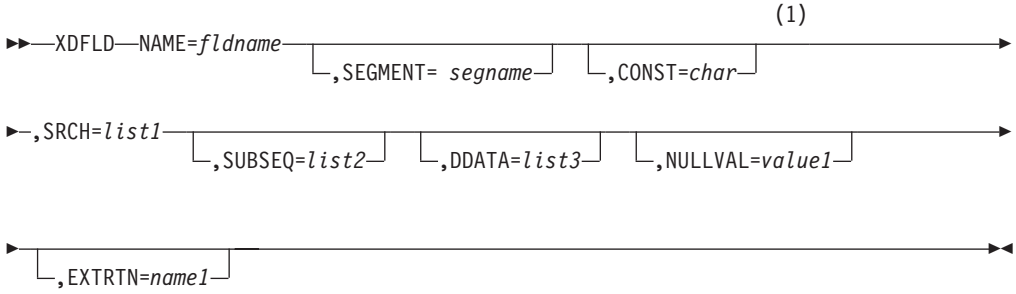


Notes:

1 An XDFLD statement is not allowed during DBD generation of a simple HISAM database.

2 The combined length of the CONSTANT, SEARCH, and SUBSEQUENCE fields must not exceed 240 bytes.

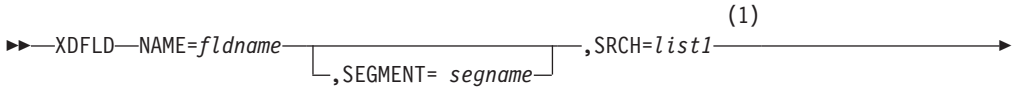
HDAM Database XDFLD Statement

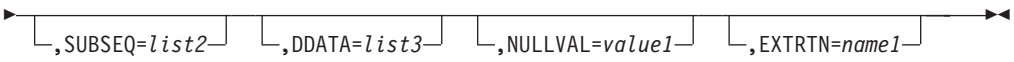


Notes:

1 The combined length of the CONSTANT, SEARCH, and SUBSEQUENCE fields must not exceed 240 bytes.

PHDAM Database XDFLD Statement





Notes:

1 The combined length of the SEARCH and SUBSEQUENCE fields must not exceed 240 bytes.

XDFLD Statement Parameter Description

NAME=
Specifies the name of the indexed data field of an index target segment. The name specified actually represents the search field of an index pointer segment type as being a field in the index target segment type. You can use the name specified to qualify SSAs of calls for an index target segment type through the search field keys of index pointer segments. This enables accessing occurrences of an index target segment type through a primary or secondary processing sequence based on data contained in a secondary index. fldname must be a 1- to 8-character alphanumeric value.

Since the name specified is used to access occurrences of the index target segment type based on the content of a secondary index, the name specified must be unique among all field names specified for the index target segment type.

SEGMENT=
Specifies the index source segment type for this secondary index relationship. *segname* must be the name of a subsequently defined segment type, which is hierarchically below the index target segment type or it can be the name of the index target segment type itself. The segment name specified must not be a logical child segment. If this parameter is omitted, the index target segment type is assumed to be the index source segment.

CONST=
Specifies a character with which every index pointer segment in a particular secondary index is identified. This parameter is optional. The purpose of this parameter is to identify all index pointer segments associated with each secondary index when multiple secondary indexes reside in the same secondary index database. Char must be a 1-byte self-defining term.

Restriction: CONST is **not** supported for HALDBs. An error will occur if it is present for a HALDB.

SRCH=
Specifies which field or fields of the index source segment you must use as the search field of a secondary index. *list1* must be a list of one to five field names defined in the index source segment type by FIELD statements. If two or more names are included, they must be separated by commas and enclosed in parentheses. The sequence of names in the list is the sequence in which the field values are concatenated in the index pointer segment search field. The sum of the lengths of the participating fields constitutes the index target segment indexed field length which must be reflected in segment search arguments.

SUBSEQ=
Specifies which, if any, fields of the index source segment you must use as the subsequence field of a secondary index. *list2* must be a list of one to five field names defined in the index source segment by FIELD statements. If two or

more names are included, they must be separated by commas and enclosed in parentheses. The sequence of names in the list is the sequence in which field values are concatenated in the index pointer segment subsequence field. This parameter is optional.

DDATA=
Specifies which, if any, fields of the index source segment you must use as the duplicate data field of a secondary index. *list3* must be a list of one to five field names defined in the index source segment by FIELD statements. If two or more names are included, they must be separated by commas and enclosed in parentheses. The sequence of names in the list is the sequence in which field values are concatenated in the index pointer segment duplicate data field. This parameter is optional.

NULLVAL=
Lets you suppress the creation of index pointer segments when the index source segment data used in the search field of an index pointer segment contains the specified value.

The value1 parameter must be a 1-byte self-defining term (X'10',C'Z', 5, or B'00101101') or the words BLANK or ZERO. BLANK is equivalent to C' ' or X'40'. ZERO is equivalent to X'00' or 0, but not C'0'. If a packed decimal value is required, it must be specified as a hexadecimal term with a valid number digit and zone or sign digit (X'3F' for a packed positive 3 or X'9D' for negative 9).

No indexing is performed when each field of the index source segment specified in the SRCH= parameter has the value of this parameter in every byte. For example, if the NULLVAL=C'9' were specified, the associated index would have no entries indexed on the value C'9999...9'.

There is a slight difference in the case of packed fields. For packed fields, each field that composes the search field is considered to be a separate packed value.

Example: If the NULLVAL=X'9F' were specified in a case where the search field was composed of three 2-byte packed source fields, there would be no index entries with the search field value of X'999F999F999F' because all index entries containing a X'9F'would be suppressed.

Also, with the same NULLVAL=X'9F', if the search field were one 6-byte field, no indexing would be performed whenever the value of the search field was X'99999999999F'.

The only form of the sign that is checked is the form specified.

Example: If X'9C' is specified, X'9F' does not cause suppression.

EXTRTN=
Specifies the name of a user-supplied index maintenance exit routine that is used to suppress the creation of selected index pointer segments. The parameter (name1) must be the name of a user-supplied routine which receives control whenever DL/I attempts to insert, delete or replace an index entry because of changes occurring in the indexed database. This exit routine can inspect the affected index source segment and decide whether or not an index pointer segment should be generated.

If both the NULLVAL= and the EXTRTN= operands are specified, indexing of a segment is performed only if neither causes suppression.

DBDGEN, FINISH, and END Statements

There are three additional utility statements. Two are required (DBDGEN and END) and one is optional (FINISH).

The DBDGEN statement indicates the end of DBD generation statements used to define the DBD. This statement is required. The following example shows the format of the DBDGEN statement for all database types.

The FINISH statement is optional and is retained for compatibility. The following example shows the format of the FINISH statement for all database types.

The END statement indicates the end of input statements to the assembler. This statement is required. The following example shows the format of the END statement for all database types.

DBD Generation Output

Three types of printed output and a load module, which becomes a member of the partitioned data set named IMS.DBDLIB, are produced by a DBD generation. Each of these outputs is described in the following sections.

Control Statement Listing

This is a listing of the input statement images to this job step.

Diagnostics

Errors discovered during the processing of each statement result in diagnostic messages. These messages are printed immediately following the image of the last statement that is read. The message can reference either the statement immediately preceding it or the preceding group of statements. It is also possible that more than one message could be printed for each statement.

In this case, these messages follow each other on the output listing. After all the statements have been read, a further check is made of the reasonableness of the entire deck. This might result in one or more additional diagnostic messages.

Any discovered error results in the diagnostic messages being printed, the statements being listed, and the other outputs being suppressed. However, all the statements are read and checked before the DBD generation execution is terminated. The link-edit step of DBD generation is not processed if a statement error has been found.

Assembler Listing

An assembler language listing of the DBD macro expansion created by DBD generation execution is provided. You can eliminate a printout of this listing by including an assembler language PRINT NOGEN statement.

If the DBD generation is for a database that uses VSAM as the operating system access method, a page in the assembler listing will provide recommended values for some of the parameters necessary to define the data sets of the database to VSAM. CONTROLINTERVALSIZE and RECORDSIZE values other than those recommended might be desired for special reasons, such as performance improvement.

Note: RECORDSIZE needs to be changed appropriately for all ESDS definitions.

If the control interval size is not specified (see 37), it defaults to the size recommended in this assembler listing. The following example shows the output produced for a HISAM database. The parameters provided are in the format required forAccess Method Services statements. The first DEFINE provides parameters for the key sequenced data set (KSDS) and the second DEFINE provides parameters for the entry sequenced data set (ESDS).

To provide a complete definition for a VSAM data set, you must add parameters for data set name (NAME), space allocation (CYL), and volume assignment (VOLUMES) to those provided by DBD generation. Optional parameters such as FREESPACE and WRITECHECK can be included if desired.

If you use the /DBD command to allow an offline dump of a VSAM database, you must use SHARE OPTIONS(3) in the VSAM DEFINE operation for the data sets of the database. See Figure 6 for an example of Access Method Services parameters from DBD generation.

```
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
+*,*
+*,     RECOMMENDED VSAM DEFINE CLUSTER PARAMETERS
+*,*
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
+*,*                   *NOTE 1
+*,     DEFINE CLUSTER (NAME(DDI3I1) -
+*,*           INDEXED KEYS (10,6) -
+*,*           RECORDSIZE (680,680) -
+*,*           DATA (CONTROLINTERVALSIZE (4096))
+*,*  *NOTE 1: SHOULD SPECIFY DSNAME FOR DDI3I1
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
+*,*                   *NOTE 2
+*,*    DEFINE CLUSTER (NAME(DDI3O1) NONINDEXED -
+*,*           RECORDSIZE (680,680) -
+*,*           CONTROLINTERVALSIZE (4096))
+*,*  *NOTE 2: SHOULD SPECIFY DSNAME FOR DDI301
+*,* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
```

Figure 6. Example of Access Method Services Parameters from DBD Generation

Figure 7 on page 88 shows the DBDGEN input used to create the output in Figure 6.

```
SEGM NAME=SEGB2,PARENT=((SEGA1)),BYTES=15,FREQ=3
FIELD NAME=(FLDB2,SEQ,U),BYTES=9,START=3,TYPE=C
SEGM NAME=SEGC1,PARENT=((SEGB2)),BYTES=20,FREQ=7
FIELD NAME=(FLDC1,SEQ,U),BYTES=10,START=4,TYPE=C
DBDGEN
FINISH
END
```

Figure 7. Example of DBDGEN Input

Segment flags are printed in DBD generation output to confirm what has been generated by that particular DBD generation. The flags, when interpreted, tell you which pointer options were generated; the segment insert, delete, and replace rules specified; whether physical child pointers have been reserved in this segment's prefix; and how many physical children are related to the segment. Segment flags appear in the output as an assembler language defined constant (DC) statement. The constant is defined as 8 hexadecimal digits followed by the comment, SEGMENT FLAGS. Each pair of digits in the constant is a hexadecimal byte. To interpret the constant, convert the first 6 digits to binary values, and the last 2 digits to decimal values as shown in Figure 8 on page 89.

```
        CONVERTED
BYTE    VALUE         DESCRIPTION

 0                    POINTER POSITIONS GENERATED:

        1.......      CTR (Counter)
        .1......      Physical twin forward
        .11.....      Physical twin forward and backward
        ...1....      Physical parent
        ....1...      Logical twin forward
        ....11..      Logical twin forward and backward
        ......1.      Logical parent
        .1.....1      Hierarchic forward
        .11....1      Hierarchic forward and backward

 1                    SEGMENT PROCESSING RULES:

        10......      Insert physical
        01......      Insert virtual
        11......      Insert logical
        ..10....      Insert nonsequential last
        ..01....      Insert nonsequential first
        ..11....      Insert nonsequential here at current position
        ....10..      Replace physical
        ....01..      Replace virtual
        ....11..      Replace logical
        ......10      Delete physical
        ......01      Delete virtual
        ......11      Delete logical
        ......00      Bivirtual delete

2       ..XX.XXX      Reserved
      1.......      Segment is paired
        .1......      Segment is a direct dependent in a FP DEDB
        ....1...      Segment's parent has two physical child
                      pointers; hierarchic pointers were not specified

3       0-254         Number of physical children of this segment
                      pointed to by physical child pointers
```

Figure 8. Segment Flag Codes

Segment Prefix Format Description

Output from DBD generation contains the statement:

```
DC  X'FEFD080A'  SEGMENT FLAGS
```

Convert the values to binary and decimal representations:

```
  Byte 0   Byte 1    Byte 2    Byte 3
   FE       FD        08       0A
11111110  11111101  00001000   10
```

Byte 0 Segment has counter, physical twin forward and backward, logical twin forward and backward, physical parent, and logical parent pointers.

Byte 1 The insert and replace rules specified are logical, and the delete rule specified is virtual. Nonsequenced inserts at current position.

Byte 2 Two 4-byte fields are reserved for physical child pointers in the parent of this segment.

Byte 3 This segment is the parent of 10 physical children.

Load Module

DBD generation is a two-step operating system job. Step 1 is a macro assembly execution which produces an object module that becomes input to Step 2. Step 2 is a link-edit of the object module, which produces a load module that becomes a member of the IMS.DBDLIB library.

DBD Generation Error Conditions

Related Reading: Refer to *IMS Version 9: Messages and Codes, Volume 1* for the DBD generation error messages.

If operands or parameters other than those shown for each type of database are coded, or if operands or parameters that are necessary are omitted, one or more of the following conditions can occur:

- DBD generation issues diagnostic messages that:
  - Flag operands or parameters that are not shown for the type of database being defined
  - Indicate that operands or parameters that are required for the type of database being defined were omitted
- DBD generation completes, but DL/I ignores the control information that was generated by the specification of operands or parameters that are not shown for the type of database that was defined.
- DBD generation completes, but DL/I is unable to create and access the defined database because (a) conflicting control information was specified when attempting to interrelate databases, or (b) segment relationships describing the application program's view of the database were not properly defined in the DBD generation.
- DBD generation completes, and DL/I creates and accesses a database. However, the results provided to you are not those you desired. This condition can occur because the default actions taken by DL/I in response to finding missing or conflicting control information are actions that you had not considered during DBD generation.

DBD Generation Examples

This section contains examples of DBD generation for different database types.

Examples without Secondary Index or Logical Relationships

The DBD generation examples provided in the following section show the statements that are required to define HSAM, HISAM, HDAM, HIDAM, primary HIDAM Index, GSAM, and MSDB and DEDB databases without secondary indexes or logical relationships. Two data structures are shown in Figure 9 on page 91. One represents the hierarchic order of data used in a payroll inventory data structure, which includes NAME, ADDRESS, and PAYROLL. The other structure represents the hierarchic order of data used in a skills inventory data structure, which includes SKILL, NAME, EXPERIENCE, and EDUCATION. One or both structures are the basis for the examples in Figure 9 on page 91 through Figure 20 on page 101.

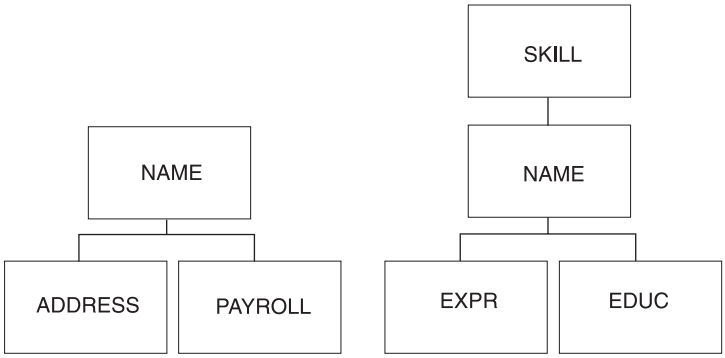


Figure 9. Payroll and Skills Inventory Data Structures

HSAM DBD Generation Example

The examples in Figure 10 show the DBD generation statements that define the skills inventory and payroll data structures as HSAM databases.

HSAM DBD Generation of Skills Inventory Database

```
DBD   NAME=SKILLINV,ACCESS=HSAM
DATASET DD1=SKILHSAM,DD2=HSAMOUT,BLOCK=1,
      RECORD=3000

SEGM  NAME=SKILL,BYTES=31,FREQ=100
FIELD NAME=TYPE,BYTES=21,START=1,TYPE=C
FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM  NAME=NAME,BYTES=20,FREQ=500,PARENT=SKILL
FIELD NAME=STDCLEVL,BYTES=20,START=1,TYPE=C

SEGM  NAME=EXPR,BYTES=20,FREQ=10,PARENT=NAME
FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM  NAME=EDUC,BYTES=75,FREQ=5,PARENT=NAME
FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 10. HSAM DBD Generation (Part 1 of 2)

HSAM DBD Generation of Payroll Database

```
DBD   NAME=PAYROLDB,ACCESS=HSAM
DATASET DD1=PAYROLL,DD2=PAYOUT,BLOCK=1,RECORD=1000,

SEGM  NAME=NAME,BYTES=150,FREQ=1000,PARENT=0
FIELD NAME=(EMPLOYEE,SEQ,U),BYTES=60,START=1,TYPE=C
FIELD NAME=MANNBR,BYTES=15,START=61,TYPE=C
FIELD NAME=ADDR,BYTES=75,START=76,TYPE=C

SEGM  NAME=ADDRESS,BYTES=200,FREQ=2,PARENT=NAME
FIELD NAME=HOMEADDR,BYTES=100,START=1,TYPE=C
FIELD NAME=COMAILOC,BYTES=100,START=101,TYPE=C

SEGM  NAME=PAYROLL,BYTES=100,FREQ=1,PARENT=NAME
FIELD NAME=HOURS,BYTES=15,START=51,TYPE=P
FIELD NAME=BASICPAY,BYTES=15,START=1,TYPE=P

DBDGEN
FINISH
END
```

Figure 10. HSAM DBD Generation (Part 2 of 2)

HISAM DBD Generation Example

The examples in Figure 11 show the DBD generation statements that define the skills inventory and payroll data structures as HISAM databases.

HISAM DBD Generation of Skills Inventory SKILLINV Database

```
DBD   NAME=SKILLINV,ACCESS=HISAM
DATASET DD1=SKLHISAM,OVFLW=HISAMOVF,

SEGM  NAME=SKILL,BYTES=31,FREQ=100
FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM  NAME=NAME,BYTES=20,FREQ=500,PARENT=SKILL
FIELD NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM  NAME=EXPR,BYTES=20,FREQ=10,PARENT=NAME
FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM  NAME=EDUC,BYTES=75,FREQ=5,PARENT=NAME
FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 11. HISAM DBD Generations (Part 1 of 2)

HISAM DBD Generation of Payroll Database

```
DBD   NAME=PAYROLDB,ACCESS=HISAM
DATASET DD1=PAYROLL,OVFLW=PAYROLOV,

SEGM  NAME=NAME,BYTES=150,FREQ=1000,PARENT=0
FIELD NAME=(EMPLOYEE,SEQ,U),BYTES=60,START=1,TYPE=C
FIELD NAME=MANNBR,BYTES=15,START=61,TYPE=C
FIELD NAME=ADDR,BYTES=75,START=76,TYPE=C

SEGM  NAME=ADDRESS,BYTES=200,FREQ=2,PARENT=NAME
FIELD NAME=HOMEADDR,BYTES=100,START=1,TYPE=C
FIELD NAME=COMAILOC,BYTES=100,START=101,TYPE=C

SEGM  NAME=PAYROLL,BYTES=100,FREQ=1,PARENT=NAME
FIELD NAME=HOURS,BYTES=15,START=51,TYPE=P
FIELD NAME=BASICPAY,BYTES=15,START=1,TYPE=P

DBDGEN
FINISH
END
```

Figure 11. HISAM DBD Generations (Part 2 of 2)

HDAM DBD Generation Example

The examples in Figure 12 show the statements required to define the skills inventory data structure as HDAM databases. The first example defines a database that uses hierarchic pointers, and the second example defines a database that uses physical child and physical twin pointers. The third example defines a database that uses the VERSION= and EXIT= parameters.

HDAM DBD Generation of Skills Inventory SKILLINV Database with Hierarchic Pointers

```
DBD    NAME=SKILLINV,ACCESS=HDAM,RMNAME=(RAMDMODL,1,500,824)
DATASET    DD1=SKILHDAM,BLOCK=1648,SCAN=5

SEGM   NAME=SKILL,BYTES=31,PTR=H,PARENT=0
FIELD  NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD  NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM   NAME=NAME,BYTES=20,PTR=H,PARENT=SKILL
FIELD  NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM   NAME=EXPR,BYTES=20,PTR=H,PARENT=NAME
FIELD  NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD  NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM   NAME=EDUC,BYTES=75,PTR=H,PARENT=NAME
FIELD  NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD  NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 12. HDAM DBD Generation (Part 1 of 3)

HDAM DBD Generation of Skills Inventory Database with Physical Child and Physical Twin Pointers

```
DBD    NAME=SKILLINV,ACCESS=HDAM,RMNAME=(RAMDMODL,1,500,824)
DATASET    DD1=SKILHDAM,BLOCK=1648,SCAN=5

SEGM   NAME=SKILL,BYTES=31,PTR=T,PARENT=0
FIELD  NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD  NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM   NAME=NAME,BYTES=20,PTR=T,PARENT=((SKILL,SNGL))
FIELD  NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM   NAME=EXPR,BYTES=20,PTR=T,PARENT=((NAME,SNGL))
FIELD  NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD  NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM   NAME=EDUC,BYTES=75,PTR=T,PARENT=((NAME,SNGL))
FIELD  NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD  NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 12. HDAM DBD Generation (Part 2 of 3)

HDAM DBD Generation of Skills Inventory SKILLINV Database with EXIT= and VERSION= Parameters

```
DBD    NAME=SKILLINV,ACCESS=HDAM,RMNAME=(RAMDMODL,1,500,824),VERSION=CCCCCC
DATASET    DD1=SKILHDAM,BLOCK=1648,SCAN=5

SEGM   NAME=A,BYTES=8,PTR=H,PARENT=0,EXIT=(EXITA)
FIELD  NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD  NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM   NAME=B,BYTES=20,PTR=H,PARENT=SKILL,(EXIT=(EXITB,(CASCADE,KEY))
FIELD  NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM   NAME=C,BYTES=8,PTR=H,PARENT=A,EXIT=((EXITA,PATH),(EXITC))
FIELD  NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD  NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM   NAME=EDUC,BYTES=75,PTR=H,PARENT=NAME
FIELD  NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD  NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 12. HDAM DBD Generation (Part 3 of 3)

HIDAM DBD Generation Example

A HIDAM database is indexed through the sequence field of its root segment type. In defining the HIDAM and primary HIDAM index databases, an index relationship is established between the HIDAM root segment type and the segment type defined in the primary HIDAM index database. Figure 13 summarizes the statements required to establish the index relationship between the HIDAM root segment type and the

index segment type in the primary HIDAM index database. Only those operands pertinent to the index relationship are shown.

Primary HIDAM Index Relationship

```
HIDAM:                          INDEX:

DBD NAME=dbd1,ACCESS=HIDAM      DBD NAME=dbd2,ACCESS=INDEX

SEGM NAME=seg1,BYTES=,          SEGM NAME=seg2,BYTES=
     POINTER=

LCHILD NAME=(seg2,dbd2),        LCHILD NAME=(seg1,dbd1),
       PTR=INDX                        INDEX=fld1

FIELD NAME=(fld1,SEQ,U),        FIELD NAME=(fld2,SEQ,U),
      BYTES=,START=                   BYTES=,START=
```

Figure 13. Summary of Statements for the Primary HIDAM Index Relationship

The next two examples show the statements that define the skills inventory data structure as two HIDAM databases. The first is defined with hierarchic pointers, and the second is defined with physical child and physical twin pointers. Since a HIDAM database is indexed on the sequence field of its root segment type, an INDEX DBD generation is required. Figure 14 shows the statements for the two HIDAM DBD generations and the index DBD generation.

INDEX DBD Generation for HIDAM Database SKILLINV

```
DBD   NAME=INDEXDB,ACCESS=INDEX
DATASET DD1=INDXDB1,
SEGM  NAME=INDEX,BYTES=21,FREQ=10000
LCHILD NAME=(SKILL,SKILLINV),INDEX=TYPE
FIELD NAME=(INDXSEQ,SEQ,U),BYTES=21,START=1
DBDGEN
FINISH
END
```

Figure 14. HIDAM and Primary HIDAM Index DBD Generations (Part 1 of 3)

Examples

HIDAM DBD Generation of Skills Inventory Database with Hierarchic Pointers

```
DBD    NAME=SKILLINV,ACCESS=HIDAM
DATASET   DD1=SKLHIDAM,BLOCK=1648,SCAN=5

SEGM  NAME=SKILL,BYTES=31,PTR=H,PARENT=0
FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C
LCHILD NAME=(INDEX,INDEXDB),PTR=INDX

SEGM  NAME=NAME,BYTES=20,PTR=H,PARENT=SKILL
FIELD NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM  NAME=EXPR,BYTES=20,PTR=H,PARENT=NAME
FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM  NAME=EDUC,BYTES=75,PTR=H,PARENT=NAME
FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 14. HIDAM and Primary HIDAM Index DBD Generations (Part 2 of 3)

HIDAM DBD Generation of Skills Inventory SKILLINV Database with Physical Child and Physical Twin Pointers

```
DBD    NAME=SKILLINV,ACCESS=HIDAM
DATASET   DD1=SKLHIDAM,BLOCK=1648,SCAN=5

SEGM  NAME=SKILL,BYTES=31,PTR=T,PARENT=0
LCHILD NAME=(INDEX,INDEXDB),PTR=INDX

FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C

SEGM   NAME=NAME,BYTES=20,PTR=T,PARENT=((SKILL,SNGL))
FIELD NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C

SEGM  NAME=EXPR,BYTES=20,PTR=T,PARENT=((NAME,SNGL))
FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C

SEGM  NAME=EDUC,BYTES=75,PTR=T,PARENT=((NAME,SNGL))
FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C

DBDGEN
FINISH
END
```

Figure 14. HIDAM and Primary HIDAM Index DBD Generations (Part 3 of 3)

PHDAM DBD Generation Example

Figure 15 shows the DBD generation of skills inventory database with physical child and physical twin pointers for a PHDAM database.

```
DBD    NAME=SKILLINV,ACCESS=(PHDAM,OSAM),RMNAME=(RAMDMODL,1,500,824)
SEGM   NAME=SKILL,BYTES=31,PTR=T,PARENT=0
FIELD  NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD  NAME=STDCODE,BYTES=10,START=22,TYPE=C
SEGM   NAME=NAME,BYTES=20,PTR=T,PARENT=((SKILL,SNGL))
FIELD  NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C
SEGM   NAME=EXPR,BYTES=20,PTR=T,PARENT=((NAME,SNGL))
FIELD  NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD  NAME=CLASSIF,BYTES=10,START=11,TYPE=C
SEGM   NAME=EDUC,BYTES=75,PTR=T,PARENT=((NAME,SNGL))
FIELD  NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD  NAME=SCHOOL,BYTES=65,START=11,TYPE=C
DBDGEN
END
```

Figure 15. PHDAM DBD Generations

PHIDAM DBD Generation Example

Figure 16 shows the DBD generation of skills inventory database with physical child and physical twin pointers for a PHIDAM database. No index base definitions are required.

```
 DBD    NAME=SKILLINV,ACCESS=PHIDAM
 SEGM  NAME=SKILL,BYTES=31,PTR=T,PARENT=0
 FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
 FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C
 SEGM   NAME=NAME,BYTES=20,PTR=T,PARENT=((SKILL,SNGL))
 FIELD NAME=(STDCLEVL,SEQ,U),BYTES=20,START=1,TYPE=C
 SEGM  NAME=EXPR,BYTES=20,PTR=T,PARENT=((NAME,SNGL))
 FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
 FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C
 SEGM  NAME=EDUC,BYTES=75,PTR=T,PARENT=((NAME,SNGL))
 FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
 FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C
 DBDGEN
 FINISH
 END
```

Figure 16. PHIDAM DBD Generations

GSAM DBD Generation Example

Figure 17 shows the DBD generation statements that define input and output data sets for a GSAM database.

```
DBD   NAME=CARDS,ACCESS=(GSAM,BSAM)
DATASET  DD1=ICARDS,DD2=OCARDS,RECFM=F,RECORD=80
DBDGEN
FINISH
END
```

Figure 17. GSAM DBD Generations

MSDB DBD Generation Example

Figure 18 on page 98 shows the DBD generation statements necessary to define the three types of main storage database DBDs.

Examples

DBD Generation for a Nonterminal-Related MSDB without LTERM Keys

```
DBD    NAME=MSDBLM02,ACCESS=MSDB
DATASET REL=NO
SEGM   NAME=LDM,BYTES=4
FIELD  NAME=(FIELDSEQ,SEQ,U),BYTES=1,START=1,TYPE=X
DBDGEN
FINISH
END
```

Figure 18. Main Storage Database DBD Generations (Part 1 of 4)

DBD Generation for a Nonterminal-Related MSDB with LTERM Keys

```
DBD    NAME=MSDBLM04,ACCESS=MSDB
DATASET REL=(TERM,FIELDLDM)
SEGM   NAME=LDM,BYTES=52
FIELD  NAME=FIELDSEQ,BYTES=4,START=1,TYPE=C
FIELD  NAME=FIELDX01,BYTES=2,START=5,TYPE=X
FIELD  NAME=FIELDC01,BYTES=2,START=5,TYPE=C
FIELD  NAME=FIELDH01,BYTES=2,START=7,TYPE=H
FIELD  NAME=FIELDF01,BYTES=4,START=9,TYPE=F
FIELD  NAME=FIELDC03,BYTES=2,START=13,TYPE=C
FIELD  NAME=FIELDP01,BYTES=2,START=13,TYPE=P
FIELD  NAME=FIELDP02,BYTES=1,START=15,TYPE=P
FIELD  NAME=FIELDP03,BYTES=16,START=16,TYPE=P
FIELD  NAME=FIELDH02,BYTES=2,START=32,TYPE=H
FIELD  NAME=FIELDF02,BYTES=4,START=34,TYPE=F
FIELD  NAME=FIELDX03,BYTES=12,START=38,TYPE=X
FIELD  NAME=FIELDH03,BYTES=2,START=50,TYPE=H
DBDGEN
FINISH
END
```

Figure 18. Main Storage Database DBD Generations (Part 2 of 4)

DBD Generation for a Fixed Terminal-Related MSDB

```
DBD    NAME=MSDBLM05,ACCESS=MSDB
DATASET REL=(FIXED,FIELDLDM)
SEGM   NAME=LDM,BYTES=52
FIELD  NAME=FIELDSEQ,BYTES=4,START=1,TYPE=C
FIELD  NAME=FIELDX01,BYTES=2,START=5,TYPE=X
FIELD  NAME=FIELDC01,BYTES=2,START=5,TYPE=C
FIELD  NAME=FIELDH01,BYTES=2,START=7,TYPE=H
FIELD  NAME=FIELDF01,BYTES=4,START=9,TYPE=F
FIELD  NAME=FIELDC03,BYTES=2,START=13,TYPE=C
FIELD  NAME=FIELDP01,BYTES=2,START=13,TYPE=P
FIELD  NAME=FIELDP02,BYTES=1,START=15,TYPE=P
FIELD  NAME=FIELDP03,BYTES=16,START=16,TYPE=P
FIELD  NAME=FIELDH02,BYTES=2,START=32,TYPE=H
FIELD  NAME=FIELDF02,BYTES=4,START=34,TYPE=F
FIELD  NAME=FIELDX03,BYTES=12,START=38,TYPE=X
FIELD  NAME=FIELDH03,BYTES=2,START=50,TYPE=H
DBDGEN
FINISH
END
```

Figure 18. Main Storage Database DBD Generations (Part 3 of 4)

DBD Generation for a Dynamic Terminal-Related MSDB

```
DBD    NAME=MSDBLM06,ACCESS=MSDB
DATASET REL=(DYNAMIC,FIELDLDM)
SEGM   NAME=LDM,BYTES=52
FIELD  NAME=FIELDSEQ,BYTES=4,START=1,TYPE=C
FIELD  NAME=FIELDX01,BYTES=2,START=5,TYPE=X
FIELD  NAME=FIELDC01,BYTES=2,START=5,TYPE=C
FIELD  NAME=FIELDH01,BYTES=2,START=7,TYPE=H
FIELD  NAME=FIELDF01,BYTES=4,START=9,TYPE=F
FIELD  NAME=FIELDC03,BYTES=2,START=13,TYPE=C
FIELD  NAME=FIELDP01,BYTES=2,START=13,TYPE=P
FIELD  NAME=FIELDP02,BYTES=1,START=15,TYPE=P
FIELD  NAME=FIELDP03,BYTES=16,START=16,TYPE=P
FIELD  NAME=FIELDH02,BYTES=2,START=32,TYPE=H
FIELD  NAME=FIELDF02,BYTES=4,START=34,TYPE=F
FIELD  NAME=FIELDX03,BYTES=12,START=38,TYPE=X
FIELD  NAME=FIELDH03,BYTES=2,START=50,TYPE=H
DBDGEN
FINISH
END
```

Figure 18. Main Storage Database DBD Generations (Part 4 of 4)

DEDB DBD Generation Example

Figure 19 on page 100 shows the DBD generation statements necessary to define a data entry database DBD.

Examples

DBD Generation for a DEDB

```
DEDB1      DBD     NAME=DEDB0001,ACCESS=DEDB,RMNAME=RMOD1
AREA0      AREA    DD1=DB1AREA0,       AREA 0
                   MODEL=1,SIZE=1024,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA1      AREA    DD1=DB1AREA1,       AREA 1
                   MODEL=11,SIZE=1024,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA2      AREA    DD1=DB1AREA2,       AREA 2
                   SIZE=1024,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA3      AREA    DD1=DB1AREA3,       AREA 3
                   SIZE=4096,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA4      AREA    DD1=DB1AREA4,       AREA 4
                   MODEL=1,SIZE=2048,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA5      AREA    DD1=DB1AREA5,       AREA 5
                   MODEL=2,SIZE=4096,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA6      AREA    DD1=DB1AREA6,       AREA 6
                   SIZE=1024,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
AREA7      AREA    DD1=DB1AREA7,       AREA 7
                   SIZE=2048,
                   ROOT=(10,5),        5 UOW'S/AREA
                   UOW=(15,10)         5 A.P.'S + 10 DEP. OFLOW.
ROOTSEG    SEGM    NAME=ROOTSEG1,PARENT=0,BYTES=(300,50)
ROOTLFLD   FIELD   NAME=(ROOTKEY1,SEQ,U),BYTES=8,START=3,TYPE=C
SDSEG      SEGM    NAME=SDSEGNM1,PARENT=ROOTSEG1,BYTES=(300,50),
                   TYPE=SEQ
SDFLD      FIELD   NAME=SDSCFLD1,BYTES=10,START=3,TYPE=C
DDSEG      SEGM    NAME=DDSEGNM1,PARENT=ROOTSEG1,
                   BYTES=(40,15),TYPE=DIR
DDFLD1     FIELD   NAME=(DD1FLD1,SEQ,U),BYTES=4,START=6
DDFLD2     FIELD   NAME=DD1FLD2,BYTES=5,START=10,TYPE=P
           DBDGEN
           FINISH
           END
```

Figure 19. Data Entry Database DBD Generations

Figure 20 shows the DBD generation statements necessary to define a DEDB with subset pointers.

DBD Generation for DEDB Subset Pointers

```
DBD NAME=DEDBDB,ACCESS=DEDB,RMNAME=DBFHD040
AREA  DD1=DEDBDD,MODEL=1,SIZE=1024,
             ROOT=(10,5),UOW=(15,10)
SEGM  NAME=A,BYTES=(48,27),PARENT=0
FIELD NAME=(A1,SEQ,U),BYTES=10,START=3,TYPE=C
SEGM  NAME=B,BYTES=(24,11),PARENT=((A,SNGL)),TYPE=DIR,SSPTR=5
FIELD NAME=(B1,SEQ,U),BYTES=5,START=3,TYPE=C
FIELD NAME=B2,BYTES=5,START=10,TYPE=C
SEGM  NAME=C,BYTES=(34,32),PARENT=((B,DBLE)),RULES=(,HERE),TYPE=DIR
FIELD NAME=(C1,SEQ,U),BYTES=20,START=3,TYPE=C
SEGM  NAME=D,BYTES=(52,33),PARENT=((A,DBLE)),TYPE=DIR,SSPTR=3
FIELD NAME=(D1,SEQ,U),BYTES=2,START=3,TYPE=C
SEGM  NAME=B,BYTES=(52,33),PARENT=((A,DBLE)),RULES=(,FIRST),TYPE=DIR
FIELD NAME=(B1,SEQ,U),BYTES=2,START=3,TYPE=C
DBDGEN
FINISH
END
```

Figure 20. DBD Generation of DEDB Subset Pointers Sample

Note: SSPTR=n, where n indicates the number of subset pointers

Summary of Physical Database Description Examples

An application program through a database PCB can operate on any of the databases previously described. The value of the DBDNAME= parameter on the database statement should equal the value of the NAME= parameter on a DBD statement of DBD generation. The SENSEG statements following the database statements in PSB generation should reference segments defined by SEGM statements in the named DBD generation.

When a HIDAM database is used by an application program, the value of the DBDNAME= parameter on the statement should equal the value of the NAME= parameter on the DBD statement for the HIDAM DBD generation. The LCHILD statement in the HIDAM DBD provides IMS with the relationship to the necessary INDEX DBD and index database. The INDEX DBD name should not be specified in the DBDNAME= parameter of a database PCB.

Examples with Logical Relationships

Figure 21 on page 102 shows the three types of logical relationships (unidirectional, bidirectional physically paired, and bidirectional virtually paired) that can be defined in IMS databases. Also in the figure are the statements required to define each type of relationship. Only the operands pertinent to the relationship are shown, and it is assumed that each type of relationship is defined between segments in two databases named DBD1 and DBD2.

Examples

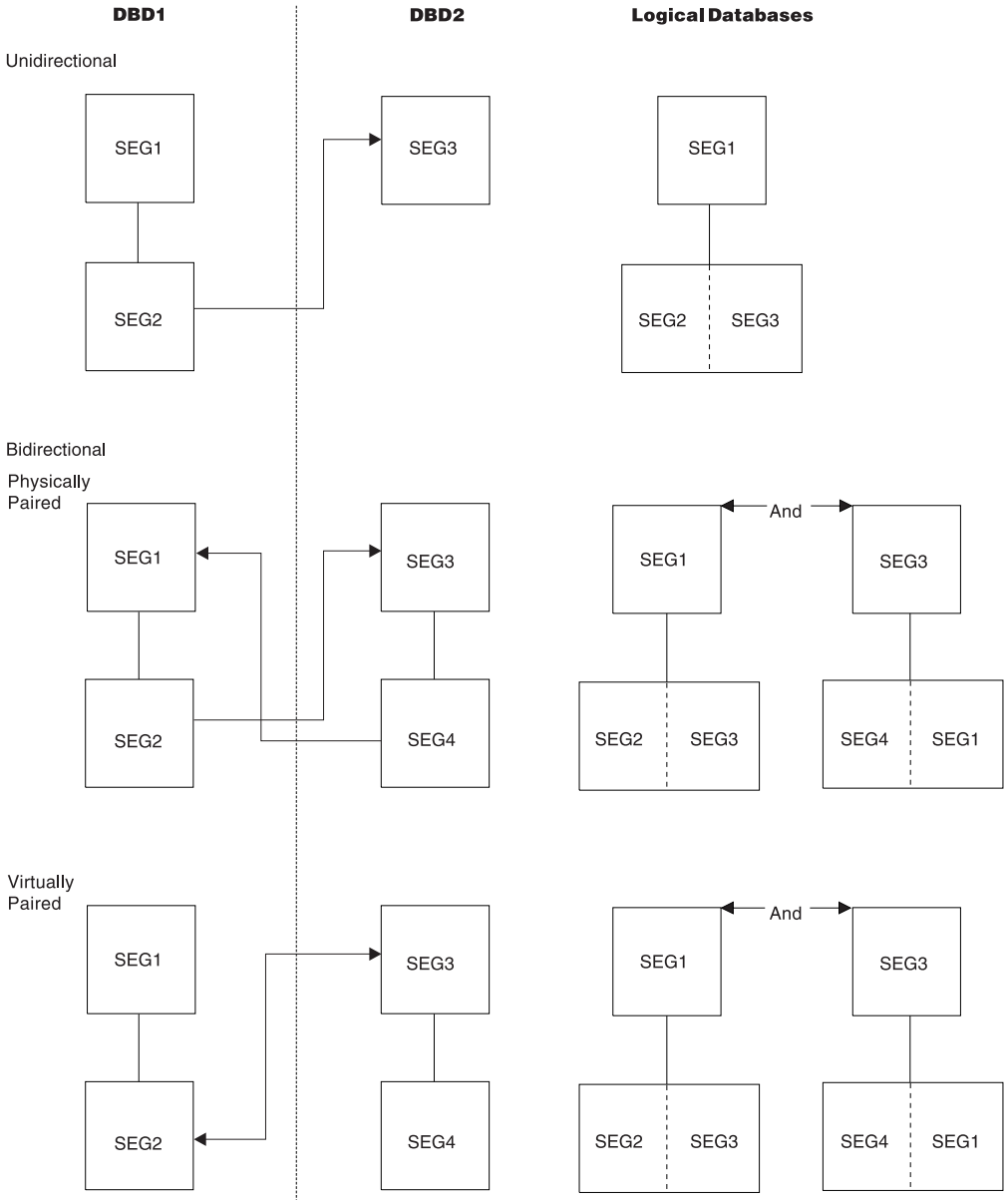


Figure 21. Comparison of Unidirectional, Physically Paired Bidirectional, and Virtually Paired Bidirectional Logical Relationships (Part 1 of 2)

Unidirectional Logical Relationships

Statements for DBD1

```
SEGM NAME=SEG1,PARENT=
 ,BYTES=,FREQ=
  ,POINTER=,RULES=


SEGM NAME=SEG2
  ,PARENT=((SEG1,)
  ,SEG3,PHYSICAL,DBD2))[1]
  ,BYTES=,FREQ=
  ,POINTER=(LPARNT)[1]
  ,RULES=
```

Statements for DBD2

```
SEGM NAME=SEG3,PARENT=
     ,BYTES=,FREQ=,POINTER=
     ,RULES=


LCHILD NAME=(SEG2,DBD1)
```

Note:

1. Specify symbolic or direct logical parent pointer. The direct access pointer can be specified only when the logical parent is in an HDAM, HIDAM, PHDAM or HIDAM database.

Physically Paired Bidirectional Logical Relationships

Statements for DBD1

```
SEGM NAME=SEG1,PARENT=
  ,BYTES=,FREQ,=
  ,POINTER=,RULES=


LCHILD NAME=(SEG4,DBD2)
  ,PAIR=SEG2


SEGM NAME=SEG2
  ,PARENT=((SEG1,)
  ,(SEG3,PHYSICAL,DBD2))[1]
  ,BYTES=,FREQ=
  ,POINTER=(LPARNT,PAIRED)[1]
  ,RULES=
```

Statements for DBD2

```
SEGM NAME=SEG3,PARENT=
  ,BYTES=,FREQ=
  ,POINTER=,RULES=


LCHILD NAME=(SEG2,DBD1)
   ,PAIR=SEG4


SEGM NAME=SEG4
  ,PARENT=((SEG3,)
  ,(SEG1,PHYSICAL,DBD1))[1]
  ,BYTES=,FREQ=
  ,POINTER=(LPARNT,PAIRED)[1]
  ,RULES=
```

Note:

1. Specify symbolic or direct logical parent pointer. The direct access pointer can be specified only when the logical parent is in an HDAM, HIDAM, PHDAM, or PHIDAM database.

Virtually Paired Bidirectional Logical Relationship

Statements for DBD1

```
SEGM NAME=SEG1,PARENT=
  ,BYTES=,FREQ=
  ,POINTER=,RULES=


SEGM NAME=SEG2
  ,PARENT=((SEG1,)
  ,(SEG3,PHYSICAL,DBD2))[1]
  ,BYTES=,FREQ=
  ,POINTER=(LTWIN,LPARNT)[2]
  ,RULES=
```

Statements for DBD2

```
SEGM NAME=SEG3,PARENT=
  ,BYTES=,FREQ=
  ,POINTER=,RULES=


LCHILD NAME=(SEG2,DBD1)
  ,POINTER=SNGL[3]
  ,PAIR=SEG4
  ,RULES=[3]
```

Notes:

1. Specify symbolic or direct logical parent pointer. The direct access pointer can be specified only when the logical parent is in an HDAM, HIDAM, PHDAM or PHIDAM database.
2. Specify LTWIN or LTWINBWD for logical twin pointers.
3. Specify DNGL or DBLE for logical child pointers. The LCHILD RULES= parameter is used when either no sequence field or a nonunique sequence field has been defined for the virtual logical child or when the virtual logical child segment does not exist.

Figure 21. Comparison of Unidirectional, Physically Paired Bidirectional, and Virtually Paired Bidirectional Logical Relationships (Part 2 of 2)

In the Virtually Paired Bidirectional Logical Relationship area of Figure 21 on page 102, a HISAM database can participate in a virtually paired logical relationship only

when the real logical child is in an HDAM, HIDAM, PHDAM, or PHIDAM database and its logical parent is in the HISAM database.

Figure 22 illustrates how logical relationships and logical databases are defined. Part 1 depicts the physical data structures of a payroll database and a skills inventory database. Part 2 depicts the logical relationship between the physical data structures, NAMEMAST (in the Payroll database) and SKILNAME (in the Skills inventory database). Part 3 depicts the logical databases (SKILL and NAME) that can be defined as a result of the logical relationships. The new databases contain segments from both the NAMEMAST structure and the SKILNAME structure. Examples of DBD generation statements follow Figure 22.

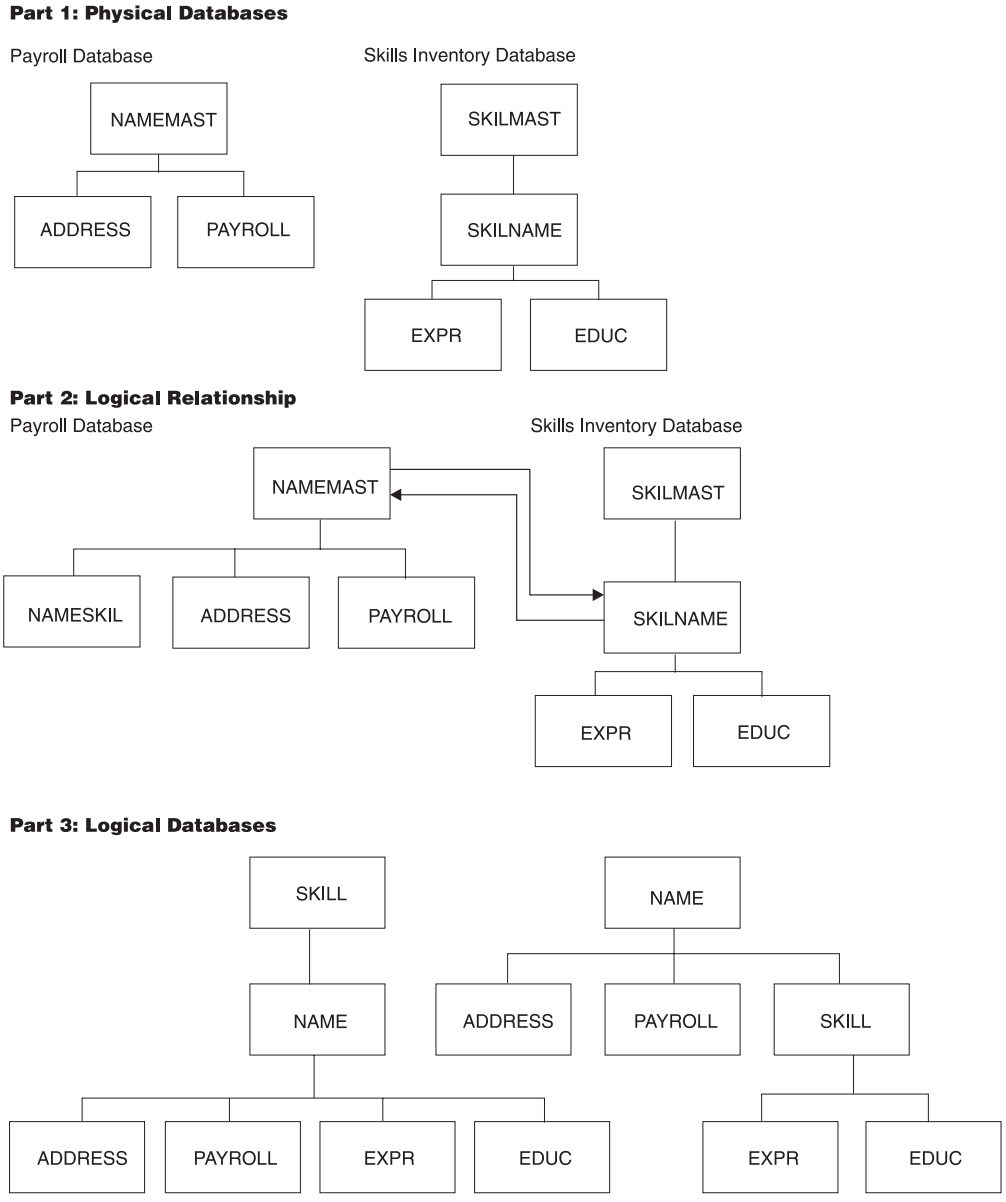


Figure 22. Logical Relationship Between Physical Databases and The Resulting Logical Databases That Can Be Defined

Figure 23 on page 105 shows the DBD generation statements necessary to define:

- The payroll and skills inventory data structures depicted in Part 2 of Figure 22 as a HIDAM and HDAM data base with a virtually paired bidirectional logical relationship between the two databases
- The logical data structures depicted in Part 3 of Figure 22 as logical databases

```
DBD    NAME=PAYROLDB,ACCESS=HIDAM
DATASET DD1=PAYHIDAM,BLOCK=1648,SCAN=3
SEGM   NAME=NAMEMAST,PTR=TWINBWD,RULES=(VVV),                  X
       BYTES=150
LCHILD NAME=(INDEX,INDEXDB),PTR=INDX
LCHILD  NAME=(SKILNAME,SKILLINV),PAIR=NAMESKIL,PTR=DBLE
FIELD NAME=(EMPLOYEE,SEQ,U),BYTES=60,START=1,TYPE=C
FIELD NAME=MANNBR,BYTES=15,START=61,TYPE=C
FIELD NAME=ADDR,BYTES=75,START=76,TYPE=C
SEGM NAME=NAMESKIL,PARENT=NAMEMAST,PTR=PAIRED,                 X
      SOURCE=((SKILNAME,DATA,SKILLINV))
FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD NAME=STDLEVL,BYTES=20,START=22,TYPE=C
SEGM   NAME=ADDRESS,BYTES=200,PARENT=NAMEMAST
FIELD NAME=(HOMEADDR,SEQ,U),BYTES=100,START=1,TYPE=C
FIELD NAME=COMAILOC,BYTES=100,START=101,TYPE=C
SEGM   NAME=PAYROLL,BYTES=100,PARENT=NAMEMAST
FIELD NAME=(BASICPAY,SEQ,U),BYTES=15,START=1,TYPE=P
FIELD NAME=HOURS,BYTES=15,START=51,TYPE=P
DBDGEN
FINISH
END

DBD    NAME=SKILLINV,ACCESS=HDAM,RMNAME=(RAMDMODL,1,500,824)
DATASET    DD1=SKILHDAM,BLOCK=1648,SCAN=5
SEGM  NAME=SKILMAST,BYTES=31,PTR=TWINBWD
FIELD NAME=(TYPE,SEQ,U),BYTES=21,START=1,TYPE=C
FIELD NAME=STDCODE,BYTES=10,START=22,TYPE=C
SEGM  NAME=SKILNAME,                                           X
      PARENT=((SKILMAST,DBLE),(NAMEMAST,P,PAYROLDB)),          X
      BYTES=80,PTR=(LPARNT,LTWINBWD,TWINBWD),                  X
      RULES=(VVV)
FIELD NAME=(EMPLOYEE,SEQ,U),START=1,BYTES=60,TYPE=C
FIELD NAME=(STDLEVL),BYTES=20,START=61,TYPE=C
SEGM  NAME=EXPR,BYTES=20,PTR=T,                                X
      PARENT=((SKILNAME,SNGL))
FIELD NAME=PREVJOB,BYTES=10,START=1,TYPE=C
FIELD NAME=CLASSIF,BYTES=10,START=11,TYPE=C
SEGM  NAME=EDUC,BYTES=75,PTR=T,                                X
      PARENT=((SKILNAME,SNGL))
FIELD NAME=GRADLEVL,BYTES=10,START=1,TYPE=C
FIELD NAME=SCHOOL,BYTES=65,START=11,TYPE=C
DBDGEN
FINISH
END
```

Figure 23. DBD Generation Statements Examples (Part 1 of 2)

Examples

```
DBD    NAME=LOGICDB,ACCESS=LOGICAL
DATASET LOGICAL
SEGM   NAME=SKILL,SOURCE=((SKILMAST,,SKILLINV))
SEGM NAME=NAME,PARENT=SKILL,                                        X
       SOURCE=((SKILNAME,,SKILLINV),(NAMEMAST,,PAYROLDB))
SEGM NAME=ADDRESS,PARENT=NAME,SOURCE=((ADDRESS,,PAYROLDB))
SEGM NAME=PAYROLL,PARENT=NAME,SOURCE=((PAYROLL,,PAYROLDB))
SEGM NAME=EXPR,PARENT=NAME,SOURCE=((EXPR,,SKILLINV))
SEGM NAME=EDUC,PARENT=NAME,SOURCE=((EDUC,,SKILLINV))
DBDGEN
FINISH
END

BD    NAME=LOGIC1,ACCESS=LOGICAL
DATASET   LOGICAL
SEGM  NAME=NAME,SOURCE=((NAMEMAST,,PAYROLDB))
SEGM NAME=ADDRESS,PARENT=NAME,SOURCE=((ADDRESS,,PAYROLDB))
SEGM NAME=PAYROLL,PARENT=NAME,SOURCE=((PAYROLL,,PAYROLDB))
SEGM   NAME=SKILL,PARENT=NAME,                                      X
       SOURCE=((NAMESKIL,,PAYROLDB),(SKILMAST,,SKILLINV))
SEGM   NAME=EXPR,SOURCE=((EXPR,,SKILLINV)),PARENT=SKILL
SEGM   NAME=EDUC,SOURCE=((EDUC,,SKILLINV)),PARENT=SKILL
DBDGEN
FINISH
END
```

Figure 23. DBD Generation Statements Examples (Part 2 of 2)

Examples with Secondary Indexes

The statements required to establish a secondary index relationship between a segment type in an indexed database and a segment type in a secondary index database are summarized in Table 8, Table 9 on page 107, and Table 10 on page 108. The statements required when the index target and index source segment types are the same are shown in Table 8. In Table 9 on page 107, the index target and index source segment types are different. Table 10 on page 108 shows the statements required for a shared secondary index DBD generation. In all three tables, only those operands pertinent to the secondary index relationships are shown.

Table 8. Same Index Source and Target Segment Types

Indexed DBD	Index DBD
DBDNAME=DBD1,ACCESS=	DBDNAME=DBD2,ACCESS=INDEX
.	.
.	.
.	.
SEGMNAME[1]=SEG1,PARENT=	SEGNAME=SEG3,PARENT=0,BYTES=
,BYTES	
FIELDNAME=(FLD2,SEQ,...),BYTES=	FIELDNAME=(FLD2,SEQ,...),BYTES=
FIELDNAME=FLD1,BYTES=	,START=1
,START	
LCHILDNAME=(SEG3,DBD2),	LCHILDNAME=(SEG1,DBD1),
POINTER[2]=INDX	INDEX=XFLD,POINTER[2]=SNGL
XDFLDNAME=XFLD,SRCH=FL	

Notes to Table 8:

1. The index target segment type can be a root or a dependent segment type; it must not be either a logical child segment type or a dependent of a logical child segment type. The index source segment type must not be a logical child segment type.
2. The example is shown with direct pointers for the index pointer segment types in the index DBD. If symbolic pointing is desired, POINTER=SYMB should be specified on both LCHILD statements; symbolic pointing is required when the index target segment type is in a HISAM database.

Table 9. Different Index Source and Target Segment Types

Indexed DBD	Index DBD
DBDNAME=DBD1,ACCESS= . . . SEGNAME[1]=SEG1,BYTES=,PARENT= LCHILDNAME=(SEG4,DBD2), POINTER[2]=INDX XLFLDNAME=XFLD,SEGMENT=SEG3, SRCH=FLD3,... SEGMNAME=SEG2,BYTES= ,PARENT=SEG1 SEGMNAME[1]=SEG3 ,PARENT=SEG2 FIELDNAME=FLD3,BYTES= ,START=	DBDNAME=DBD2,ACCESS=INDEX . . . SEGMNAME=SEG4,PARENT=0,BYTES= FIELDNAME=(FLD4,SEQ,...) ,START=1,BYTES= LCHILDNAME=(SEG1,DBD1), INDEX=XFLD,POINTER[2]=SNGL

Notes to Table 9:

1. The index target segment type can be a root or a dependent segment type. It must not be either a logical child segment type or a dependent of a logical child segment type. The index source segment type must not be a logical child segment type.
2. The example is shown with direct pointers for the index pointer segment types in the index DBD. If symbolic pointing is desired, POINTER=SYMB should be specified on both LCHILD statements; symbolic pointing is required when the index target segment type is in a HISAM database.

Table 10. Shared Secondary Index Database DBD Generation

Indexed DBD	Index DBD
DBDNAME=DBD1,ACCESS= . . . SEGMNAME=SEG1,BYTES=PARENT= FIELDNAME=FLD1,BYTES= ,START= FIELDNAME=FLD2,BYTES= ,START= LCHILDNAME=(SEG3,DBD2), POINTER=INDX XDFLDNAME=XFLD1,SRCH=FLD2, CONST=C'2'... . . . SEGMNAME=SEG2,BYTES=,PARENT= FIELDNAME=FLD4,BYTES= ,START= LCHILDNAME=(SEG5,DBD3), POINTER=INDX XDFLDNAME=XFLD2,SRCH=FLD4, CONST=C'1'...	DBDNAME=(DBD2,DBD3),ACCESS=INDEX . . . SEGMNAME=SEG3,PARENT=0,BYTES=1 FIELDNAME=FLD3,SEQ,...), START=1,BYTES= LCHILDNAME=SEG1,DBD1), INDEX=XFLD1 SEGMNAME=SEG5,PARENT=0,BYTES= FIELDNAME=FLD10,SEQ,...), START=1,BYTES= LCHILDNAME=(SEG2,DBD1), INDEX=XFLD2

This example is shown with direct pointers for the index pointer segment types, and with the index source segment type, and the index target segment type the same. Symbolic pointing or differing index source and target segments types can be used; however, all secondary index databases in the shared index must uniformly specify either symbolic pointers or direct pointers; a mixture of symbolic and direct pointing is not allowed in a shared secondary index database.

Example DBDs for Secondary Index Databases

Figure 24 on page 109 shows a database, DTA1, that is indexed by two secondary index databases. The first secondary index, X1, uses the same segment for its index target segment and index source segment; the second secondary index, X2, has an index target segment that is different from its index source segment.

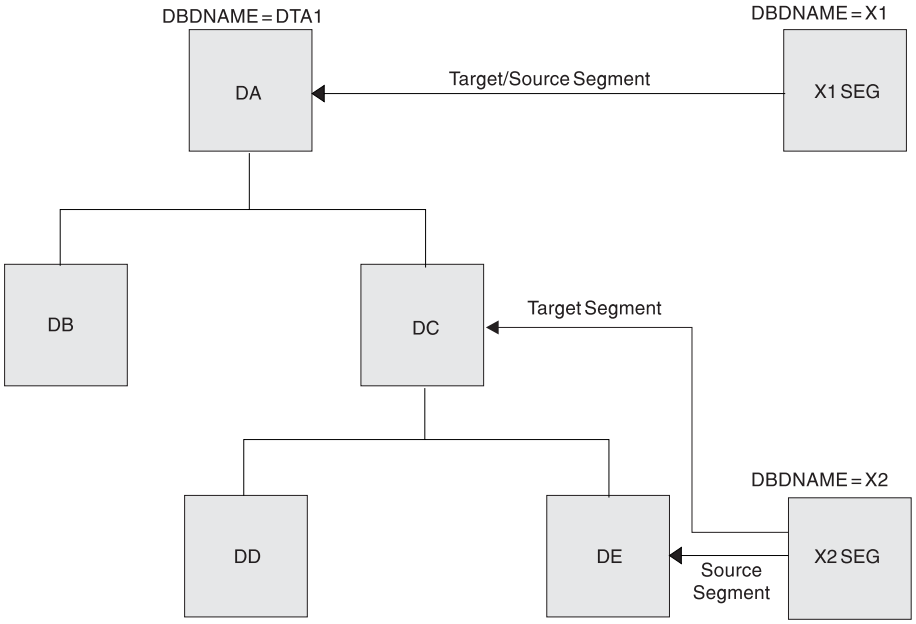


Figure 24. Database Indexed by Two Secondary Indexes

Figure 25, Figure 26, and Figure 27 on page 110 show the DBD generation statements that define the indexed database and the secondary index databases.

```
DBD     NAME=DTA1,ACCESS=HDAM,RMNAME=(RANDMODL,1,500,824)
DATASET DD1=D1,MODEL=1
SEGM    NAME=DA,PARENT=0,BYTES=15
FIELD   NAME=(DAF1,SEQ),BYTES=5,START=1
LCHILD  NAME=(X1SEG,X1),PTR=INDX
XDFLD   NAME=DAF1X,SRCH=DAF1
SEGM    NAME=DB,PARENT=DA,BYTES=20
FIELD   NAME=(DBF1,SEQ),BYTES=5,START=1
SEGM    NAME=DC,PARENT=DA,BYTES=20
FIELD   NAME=(DCF1,SEQ),BYTES=5,START=1
LCHILD  NAME=(X2SEG,X2),PTR=SYMB
XDFLD   NAME=DCF1X,SRCH=DEF1,SEGMENT=DE
SEGM    NAME=DD,PARENT=DC,BYTES=25
FIELD   NAME=(DDF1,SEQ),BYTES=5,START=1
SEGM    NAME=DE,PARENT=DC,BYTES=25
FIELD   NAME=(DEF1,SEQ),BYTES=5,START=1
DBDGEN
FINISH
END
```

Figure 25. DBD for Indexed Database

```
DBD     NAME=X1,ACCESS=INDEX
DATASET DD1=X1P,MODEL=1
SEGM    NAME=X1SEG,BYTES=5,PARENT=0
FIELD   NAME=(X1F1,SEQ,U),START=1,BYTES=5
LCHILD  NAME=(DA,DTA1),INDEX=DAF1X,POINTER=SNGL
DBDGEN
FINISH
END
```

Figure 26. DBD for Primary Index Database

Examples

```
DBD    NAME=X2,ACCESS=INDEX
DATASET DD1=X2P,MODEL=1
SEGM   NAME=X2SEG,BYTES=5,PARENT=0
FIELD  NAME=(X2F1,SEQ,U),START=1,BYTES=5
LCHILD NAME=(DC,DTA1),INDEX=DCF1X,POINTER=SYMB
DBDGEN
FINISH
END
```

Figure 27. DBD for Secondary Index X2

Example DBDs for a Shared Secondary Index Database

Figure 28 shows a database, DTA3, that is indexed by three secondary indexes (X4, X5, and X6) in a shared secondary index database. Each secondary index uses a different segment as both its index target segment and index source segment. Secondary index X4 uses DTA3 segment DA as its target/source segment. Secondary index X5 uses DTA3 segment DC as its target/source segment. Secondary index X6 uses DTA3 segment DE as its target/source segment.

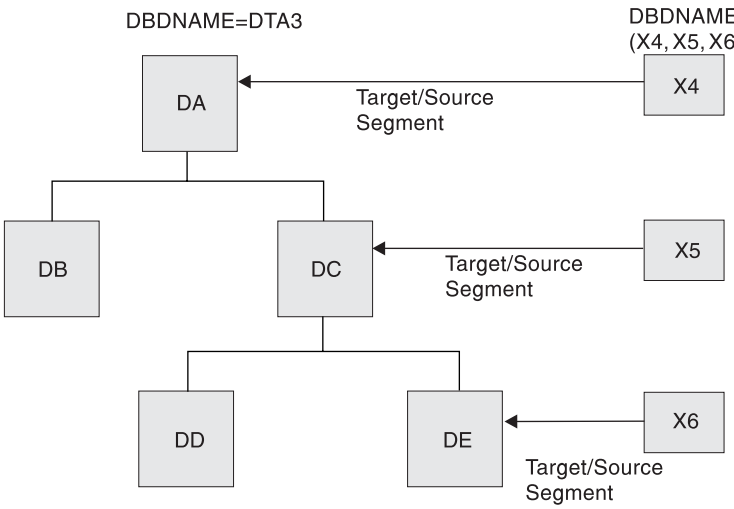


Figure 28. Database Indexed by Three Secondary Indexes in a Shared Secondary Index Database

Figure 29 on page 111 shows the DBD generation statements that define the indexed database, the primary index data base, and the shared secondary index database.

DBDGEN for Indexed Database

```
DBD    NAME=DTA3,ACCESS=HIDAM
DATASET DD1=D1
SEGM  NAME=DA,PARENT=0,BYTES=15
LCHILD NAME=(INDEX,X2),PTR=INDX
FIELD NAME=(DAF1,SEQ),BYTES=5,START=1
LCHILD NAME=(X4A,X4),PTR=INDX
XDFLD NAME=DAF1X,SRCH=DAF1,CONST=C'1'
SEGM  NAME=DB,PARENT=DA,BYTES=20
FIELD NAME=(DBF1,SEQ),BYTES=5,START=1
SEGM  NAME=DC,PARENT=DA,BYTES=20
FIELD NAME=(DCF1,SEQ),BYTES=5,START=1
LCHILD NAME=(X5A,X5),PTR=INDX
XDFLD NAME=DCF1X,SRCH=DCF1,CONST=C'2'
SEGM  NAME=DD,PARENT=DC,BYTES=25
FIELD NAME=(DDF1,SEQ),BYTES=5,START=1
SEGM  NAME=DE,PARENT=DC,BYTES=25
FIELD NAME=(DEF1,SEQ),BYTES=5,START=1
LCHILD NAME=(X6A,X6),PTR=INDX
XDFLD NAME=DEF1X,SRCH=DEF1,CONST=C'3'
DBDGEN
FINISH
END
```

DBDGEN for Primary Index Database

```
DBD   NAME=X2,ACCESS=INDEX
DATASET DD1=X2P
SEGM  NAME=INDEX,BYTES=5
LCHILD NAME=(DA,DTA3),INDEX=DAF1
FIELD NAME=(INDXSEQ,SEQ,U),BYTES=5,START=1
DBDGEN
FINISH
END
```

DBDGEN for Shared Secondary Index Database

```
DBD   NAME=(X4,X5,X6),ACCESS=INDEX
DATASET DD1=X4P,OVFLW=X40
SEGM  NAME=X4A,BYTES=6,PARENT=0
FIELD NAME=(X4F1,SEQ,U),START=1,BYTES=6
LCHILD NAME=(DA,DTA3),INDEX=DAF1X
SEGM  NAME=X5A,BYTES=6,PARENT=0
FIELD NAME=(X5F1,SEQ,M),START=1,BYTES=6
LCHILD NAME=(DC,DTA3),INDEX=DCF1X
SEGM  NAME=X6A,BYTES=6,PARENT=0
FIELD NAME=(X6F1,SEQ,M),START=1,BYTES=6
LCHILD NAME=(DE,DTA3),INDEX=DEF1X
DBDGEN
FINISH
END
```

Figure 29. Indexed Database, Primary Index Database, and Shared Secondary Index Database DBD Generations

Chapter 2. Program Specification Block (PSB) Generation

Before executing an application program under IMS, you must describe that program and its use of logical terminals and logical data structures through a program specification block (PSB) generation. The PSB generation statements supply the identification and characteristics of the IMS resources to be used. These program communication blocks (PCBs) represent message destinations and databases used by the application program. In addition, there must be a statement supplying characteristics of the application program itself. There must be one PSB for each message, batch, or Fast Path program. The name of the PSB and its associated application program must be the same in a telecommunications system.

If you require only an I/O PCB and a single, modifiable alternate PCB, you can use a generated PSB (GPSB) to describe the resources required for your application program. GPSBs can be used in any online environment, and are typically used in DCCTL application programs. You do not need to perform PSBGEN for GPSBs.

Related Reading: For more information about GPSBs, see *IMS Version 9: Installation Volume 2: System Definition and Tailoring* and *IMS Version 9: Administration Guide: Transaction Manager*.

The following topics provide additional information:

Input and Output for PSB Generation

PSB generation places the created PSB in the PSB library. Each PSB is a member of the operating system partitioned data set IMS.PSBLIB. For IMS batch execution (DL/I region type), the necessary database PCB PSB is loaded from PSBLIB and the expanded PSB needed for DL/I database PCB statement processing is built from it. ACB generation must be performed to prebuild the expanded PSBs into the ACBLIB. PSBLIB is used as input to the ACB generation process. Batch executions can also use prebuilt blocks from the ACBLIB by specifying region type 'DBB' on the JCL execute statement. When an application that is running in an online region (BMP) references a PSB with one or more GSAM PCBs defined, IMS uses ACBLIB with PSBLIB to build its internal control blocks. In this case, the PSB must be defined the same in both ACBLIB and PSBLIB.

The six types of statements used for a PSB generation are:

- PCB statements for output message destinations other than the source of the input message. These statements are called alternate PCBs, and they are used in message processing, batch message processing, and Fast Path programs that interface with the IMS message queues.
- PCB statements for DL/I and Fast Path databases. These statements are used by message, batch, and Fast Path processing programs to define interfaces to a database.
- SENSEG statements for segments within a database to which the application program is sensitive. These statements are used with message, batch, and Fast Path processing programs to define logical data structures.

- SENFLD statements for fields within a segment to which the application program is sensitive.
- PSBGEN statement for each PSB. This statement is used to indicate the characteristics of the associated application program.
- An assembler language END statement is required for each PSBGEN statement.

The list of statements used for a PSB generation does not include a PCB for the input message source. I/O PCBs exist within the IMS online control program nucleus for this purpose. Upon entry to the application program used for message processing, a PCB pointer to the source of the input message is provided as the first entry in a list of PCB address pointers. The remainder of the PCB list has a direct relationship to the PCBs as defined within the associated PSB and must be defined in the application program in the same order as defined during PSB generation. All PCBs can be used by the application program when making DL/I message and database calls. Only one PCB is used in a particular DL/I call.

You can exclude alternate, DL/I, Fast Path, and GSAM PCBs from the PCB list that is passed to the application program by defining a name for the PCB (PCBNAME=name) and specifying LIST=NO. You must name the PCB when you want to issue calls using the application interface block (AIB). The AIB can be used for all types of PCBs.

Related Reading: For more information about PCBs, see *IMS Version 9: Application Programming: Database Manager*.

To test message processing or batch message processing programs in a batch processing region, use the CMPAT option of the PSBGEN statement. When CMPAT=YES is specified, IMS provides PCBs to the application as if it were executing in a message processing region. Using CMPAT eliminates the need to recompile the program between batch and online executions.

In the case of a batch program, no I/O PCB exists in the list unless you request it with the CMPAT option on the PSBGEN statement. Therefore, if CMPAT=YES is not specified, the PCB list provided to the program has a direct relationship to the PCBs within the PSB. No TP PCBs should be contained in a PSB for batch processing in a batch processing region.

In a TM batch environment, CMPAT=YES is implied and cannot be overridden by PSBGEN. The PCB list for application programs running in a DCCTL batch region always contains an I/O PCB.

You can specify alternate PCBs in a PSB associated with a batch program operative in an IMS batch message processing region. These PCBs are available for output message queuing. A batch program operative in batch message processing regions can access messages from the input message queue. An I/O PCB is always provided as in the case of a message processing program.

You can specify alternate and modifiable alternate PCBs in a PSB associated with a Fast Path program executing in a Fast Path region. A response alternate PCB with the same PTERM can be used to send a Fast Path output message back to the original PTERM with a different component attached to the terminal. You can use an alternate PCB (non-response mode) to send an output message to any terminal or IMS message queue.

You can reference the PCB list passed to the application program upon entry to the application program by the names defined within the application program for making DL/I calls and interrogating PCB information (status codes and feedback information). The address of a PCB can be the second parameter in a DL/I call from an application program to IMS. The PCB address can represent the source of the input message, the destination for an output message, or a database. Upon completion of a DL/I call, the PCB contains status and feedback information pertinent to the call.

Related Reading: For more information about PCBs, *IMS Version 9: Application Programming: Database Manager*.

PSBGEN Procedure

IMS system definition places the procedure named PSBGEN in the IMS.PROCLIB procedure library.

This two-step assemble and link-edit procedure produces PSBs. The first step, Step C, an operating system assembly, is performed after the procedure is invoked. The second step, Step L, is a link-edit which takes the assembly output from Step C and places the PSBs in IMS.PSBLIB.

Procedure Statement

The procedure statement is shown in Figure 30. The list following the figure defines the parameters used in the statement.

```
//       PROC MBR=TEMPNAME,SOUT=A,RGN=0M,SYS2=
//C      EXEC PGM=ASMA90,REGION=&RGN,
//            PARM=(OBJECT,NODECK,NODBCS,
//            'SIZE(MAX,ABOVE)')
//SYSLIB   DD DSN=IMS.&SYS2.SDFSMAC,DISP=SHR
//SYSLIN   DD UNIT=SYSDA,DISP=(,PASS),
//         SPACE=(80,(100,100),RLSE),
//         DCB=(BLKSIZE=80,RECFM=F,LRECL=80)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(300,300),RLSE,,ROUND)
//SYSUT1   DD UNIT=SYSDA,DISP=(,DELETE),
//         SPACE=(CYL,(10,5))
//L      EXEC PGM=IEWL,PARM='XREF,LIST',
//            COND=(0,LT,C),REGION=4M
//SYSLIN   DD DSN=*.C.SYSLIN,DISP=(OLD,DELETE)
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089,
//         SPACE=(121,(90,90),RLSE)
//SYSLMOD  DD DISP=SHR,
//         DSN=IMS.&SYS2.PSBLIB(&MBR)
//SYSUT1   DD UNIT=(SYSDA,SEP=(SYSLMOD,SYSLIN)),
//         SPACE=(1024,(100,10),RLSE),DISP=(,DELETE)
```

Figure 30. PSBGEN Procedure Statement

MBR=

Is the name of the PSB generated. This name should be the same as the name specified on the PSBNAME= parameter of the PSBGEN statement. If this precaution is not followed, a user ABEND 929 can occur during execution, or message DFS929I (“BLDL FAILED FOR MEMBER”) can be received during an ACB generation “BUILD PSB” operation.

SOUT=
Specifies the SYSOUT class. The default is A.

RGN=
Specifies the region size for execution of the PSBGEN utility. The default is 512KB.

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period, for example, SYS2='IMSA.'.

Step C

Step C is the assembly step.

Related Reading: For more information about assembly steps, see *HLASM MVS & VM Programmer's Guide*.

DD Statements

SYSIN DD
Defines the input data sets to step C. These DD statements must be provided when invoking the procedure.

Step L

Step L is the link-edit step.

Example: This step can be run using AMODE=31, RMODE=24 instead of the default AMODE=24, RMODE=24 by adding AMODE=31 to the link-edit EXEC statement PARM list as shown as follows.

```
//L      EXEC  PGM=IEWL,PARM='XREF,LIST,AMODE=31',
//             COND=(0,LT,C),REGION=120K
```

If you do not specify different values for AMODE or RMODE, the default values are in effect. You must always run the link-edit step with RMODE=24.

Related Reading: For more information about linkage editors, see *z/OS MVS Program Management: User's Guide and Reference*.

DD Statements

SYSLMOD DD
Defines an output partitioned data set, IMS.PSBLIB, for the linkage editor.

Invoking the Procedure

The JCL statements in Figure 31 on page 117 are used to invoke the PSBGEN procedure.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PROC=PSBGEN,MBR=nnnnnnnn
//C.SYSIN   DD   *

          PCB
       SENSEG     (The control statements for PSB generation)
       PSBGEN     PSBNAME=TEMPNAME
       END
/*
```

Figure 31. Procedure for Invoking PSBGEN

Utility Control Statements for PSB Generation

No PCB statement is needed in PSB generation **for the I/O PCB**. IMS builds it automatically. This is true for message processing application programs, batch processing application programs that operate in IMS batch message processing regions and need to obtain input messages from the IMS message queues, and Fast Path application programs that operate in an IMS Fast Path dependent region. Batch processing application programs that operate in IMS DB batch processing regions never have an I/O PCB, unless specifically requested in the PSBGEN macro statement.

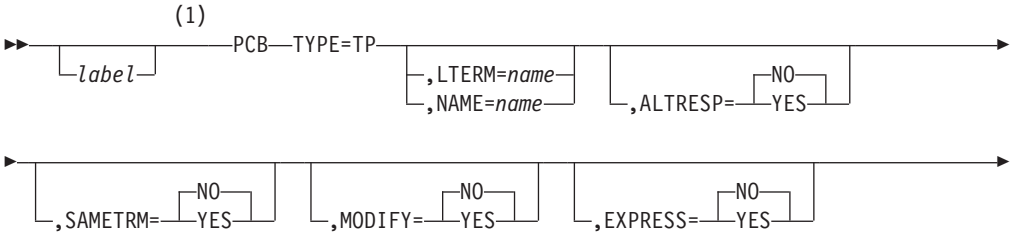
Alternate PCB Statement

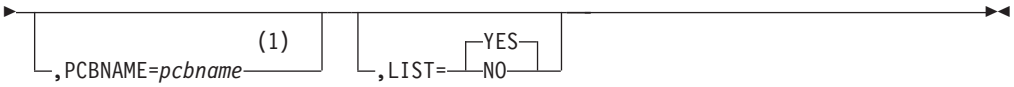
The alternate PCB describes a destination other than the source of the current input message. This statement instruction allows the application program to send output messages to a destination other than the source of an input message.

Requirement: A PCB statement is required for each destination to which output is to be sent.

These messages can be sent to either an output terminal or an input transaction queue to be processed by another program. Each output message destination requires a separate alternate PCB destination. If the input source terminal is all that is required to respond with output, do not include any PCB statements of this type. Message processing programs, batch message processing programs, and Fast Path programs can have alternate PCB statements in their associated PSBs. An alternate PCB cannot be used to send a message to a Fast Path transaction; however, Fast Path application programs can use an alternate PCB to route messages to any terminal or IMS transaction.

Alternate PCB statements must be first in the PSB generation control card deck, followed by the statements identifying PCBs associated with IMS databases. The following diagram shows the alternate PCB statement format.





Notes:

1 *label* and PCBNAME are mutually exclusive. Use only the label or the PCBNAME= parameter.

For details on the coding format for assembler macro instructions, refer to the ″Assembler Coding Conventions″ topic in the *IBM Assembler Manual*, publication number SC26-4940-03.

label
Specifies an alphanumeric label from 1 to 8 characters long, that is valid for an assembler language statement. The labels for the PCB statement within a PSB must be unique.

Exception: Do not specify this parameter if the PCBNAME= parameter is used.

PCB
Indicates that this is a PCB statement.

TYPE=TP
Is a required keyword parameter for all alternate PCBs.

LTERM=|NAME=
Is the parameter for the **output** message destination. The “name” is the actual destination of the message and is either a logical terminal name (LTERM=) or a transaction-code name (NAME=). When the name is a transaction-code name, output messages to this PCB are enqueued for input to the program used to process the transaction code named by the NAME parameter. The name must be from 1- to 8-alphanumeric characters in length, and must be specified in the user’s IMS system definition as a logical terminal name or transaction code. The LTERM= or NAME= parameter is required except when MODIFY=YES is specified.

ALTRESP=
Specifies whether (YES) or not (NO) this alternate PCB can be used instead of the I/O PCB for responding to terminals in response mode, conversational mode, or exclusive mode. The default value is NO. ALTRESP=YES is only valid for alternate PCBs.

SAMETRM=
Specifies whether (YES) or not (NO) IMS verifies that the logical terminal named in the response alternate PCB is assigned to the same physical terminal as the logical terminal that originated the input message. The default value is NO. You must specify SAMETRM=YES for response alternate PCBs used by conversational programs and programs operating with terminals in response mode. SAMETRM=NO should be specified if alternate response PCBs are used to send messages to output-only devices that are in exclusive mode.

MODIFY=
Specifies whether the alternate PCB is modifiable (YES). This feature allows for the dynamic modification of the destination name associated with this PCB. Default value is NO. If MODIFY=YES is specified, omit the NAME= or LTERM= parameter.

EXPRESS=
Specifies whether messages from this alternate PCB are to be sent (YES) or are to be backed out (NO) if the application program should abend.

YES When specified, indicates EXPRESS messages can be sent to the destination terminal even though the program abends or issues a ROLL or ROLB call. For all PCBs (express or non-express) under these conditions, messages inserted but not made available for transmission are canceled, while messages made available for transmission are never cancelled.

For a non-express PCB, the message is not available for transmission to its destination until the program reaches a sync (commit) point. The sync point occurs when the program terminates, issues a CHKP call, or requests the next input message (if the transaction is defined with MODE=SNGL).

For an express PCB, the message is available for transmission to the destination when IMS knows it has the complete message. The message is available when a PURG call is made using that PCB, or when the program requests the next input message.

When the PSB is defined as a Fast Path application in the IMS system definition, EXPRESS=YES, if specified, will be ignored at execution time for a response alternate PCB.

NO When specified, indicates messages are backed out if the application program abends. NO is the default.

PCBNAME=
Specifies the name of the PCB. The PCB name must be an alphanumeric, 8-byte character string that follows standard naming conventions. The PCB name must be unique within the PSB.

Exception: Do not specify this parameter if a label is used.

LIST=
Specifies whether the named PCB is included in the PCB list passed to the application program at entry. Specify YES to include a named PCB in the PCB list. Specify NO to exclude a named PCB from the PCB list. YES is the default.

To exclude a PCB from the PCB list, you must assign the PCB a name with the PCBNAME= parameter. You can specify LIST=NO if an application program does not need a PCB's address.

DL/I or Fast Path Database PCB Statement

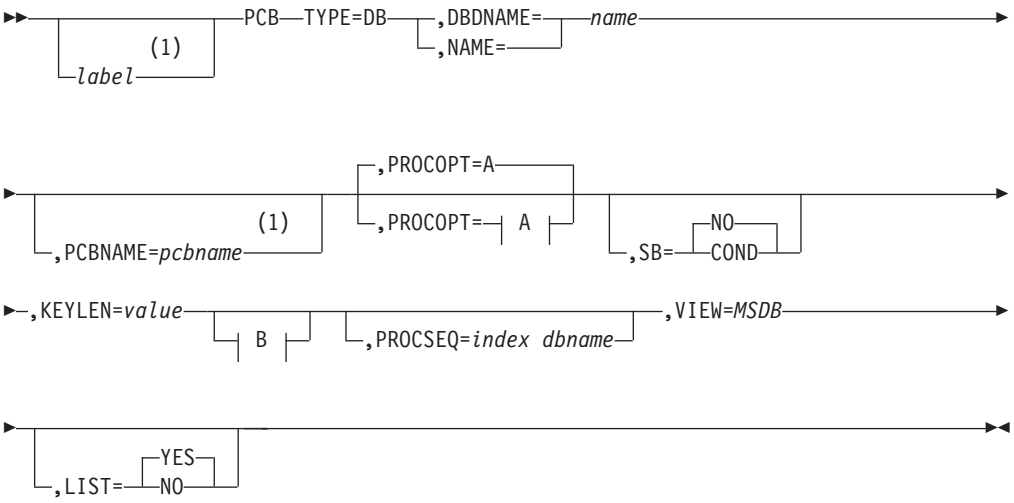
The second type of statement in a PSB generation input record specifies a description of a PCB for a DL/I or a Fast Path database. Although one or more database PCBs are usually included in a PSB, the second type of statement is not always required. For example, a message switching program or conversational message program might not require access to a DL/I database. Therefore, a database PCB is not required.

In a DCCTL environment, database PCBs (except for GSAM PCBs) are not supported, but might be included in the PSBGEN. Application programs that execute in a DCCTL environment and that attempt to use a database PCB will receive an AD status code.

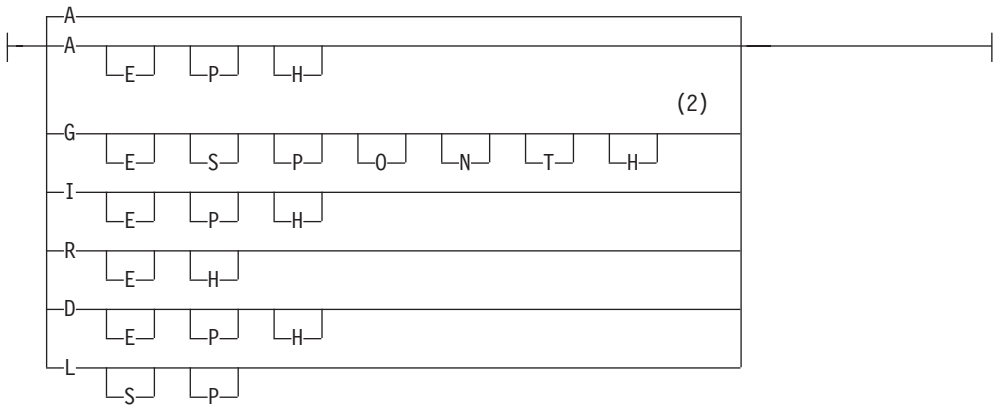
The maximum number of database PCBs that can be defined in a PSBGEN is 2500, including alternate terminal PCBs. 2500 database PCB definitions are

impractical because this many definitions can require more storage than is usually available. This is the maximum value for application programs executing in all IMS region types (MSG, DL/I, and so on).

The following diagram shows the format for the DL/I database PCB statement.



A:



B:

Notes:

1 *label* and PCBNAME are mutually exclusive. Use only the label or the PCBNAME= parameter.

2 These operands can be selected in any combination; if G, I, R, and D are selected, use A instead (A = G, I, R, and D combined).

label
An optional label used to allow the SBPARM control statement in the DFSCTL

file to reference specific PCBs. If specified, this must be an alphanumeric 1- to 8-byte character string that is valid for an assembler language statement. The labels for the PCB statements within a PSB must be unique.

Exception: Do not specify this parameter if PCBNAME= is used.

TYPE=DB
Is a required keyword parameter for all DL/I database PCBs.

DBDNAME= or NAME=
Is the parameter for the name that specifies the physical or logical DBD to be used as the primary source of database segments for this logical data structure. The logical structure, which is defined under this PCB with one or more SENSEG statements, is the hierarchical set of data segments to which the associated application program is sensitive. This logical hierarchy of data segments might or might not exist as a physical hierarchy. This depends on the relationship of segments defined by SENSEG statements and the existence of these segments in one or more databases as defined by their database descriptions (DBDs). All SENSEG statements that follow this statement and precede the next PCB or PSBGEN statement must refer to segments defined in the DBD named in the DBDNAME= or NAME= parameter of this PCB. (Refer to "SENSEG Statement" on page 131 for more information.)

The keywords DBDNAME and NAME are synonymous. DBDNAME is more descriptive, and NAME is kept for compatibility with earlier releases.

PCBNAME=
Specifies the name of the PCB. The PCB name must be an alphanumeric, 8-byte character string that follows standard naming conventions.

Exception: Do not specify this parameter if the PCB statement includes *label*.

PROCOPT= (with full function)
Is the parameter for the processing options on sensitive segments declared in this PCB that you can use in an associated application program. You can use a maximum of four options with this parameter. The letters in the parameter have the following meaning:

A All, includes the G, I, R, and D functions. PROCOPT=A is the default setting.

G Get function.

I Insert function.

R Replace function. Includes G.

D Delete function. Includes G.

P Position function. Required if command code D is to be used, except for `ISRT` calls in a batch program that is not sensitive to fields. PROCOPT=P is not required if command code D is used when processing DEDBs. Refer to "Use of PROCOPT=(with Fast Path)" on page 123 for information on how to use PROCOPT=P with DEDBs. P is used in conjunction with A, G, I, D, and L.

O If the O option is used for a PCB, IMS does not check the ownership of the segments returned. Therefore, the read without integrity program might get a segment that has been updated by another program. If the updating program abends and backs out, the read without integrity program will have a segment that does not exist in the database and never did. If a segment has been deleted and another segment of the same type has been inserted in the same location, the segment data,

and all subsequent data returned to the application, can be from a different database record. Therefore, if you use the O option, do not update based on data read with that option. O must be specified as GO, GON, GONP, GOT, GOTP, or GOP only.

Related Reading: For more information about the O option, see *IMS Version 9: Application Programming: Design Guide*.

N Reduces the number of abends that read-only application programs are subject to. Read-only application programs can reference data being updated by another application program. When this happens, an invalid pointer to the data might exist. If an invalid pointer is detected, the read-only application program abends. By specifying N, you avoid this. A GG status code is returned to the program instead. The program must determine whether to terminate processing, continue processing by reading a different segment, or access the data using a different path. N must be specified as GON, GONH, or GONP.

T Is the same as the N parameter, except that T causes DL/I to automatically retry the operation. If the retry fails, a GG status code is returned to the application program. T must be specified as GOT, GOTH, or GOTP.

E Enables exclusive use of the database or segment by online programs. Used in conjunction with G, I, D, R, and A.

L Load function for database loading (except HIDAM and PHIDAM).

GS Get segments in ascending sequence only (HSAM only). If you specify GS for HSAM databases, they will be read using the Queued Sequential Access Method (QSAM) instead of the basic Sequential Access Method (BSAM) in a DL/I IMS region.

LS Segments loaded in ascending sequence only (HIDAM, HDAM, PHIDAM, PHDAM). This load option is required for HIDAM and PHIDAM. Because you must specify LS for HIDAM and PHIDAM databases, the index for the root segment sequence field will be created at the time the database is loaded.

H Specifies high-speed sequential processing for the application program using a particular PSB. The restrictions for using PROCOPT=H are:

- It can be used for DEDBs only.
- It is allowed on the PCB level and not on the segment level.
- It must be used with other Fast Path processing options.
- A maximum of four PROCOPT options can be specified, including H.
- It can only be specified for BMPs.
- Only one PROCOPT=H PCB per database per PSB is allowed. If a BMP using HSSP uses multiple PCBs with PROCOPT=H for the same database within the same PSB, all database calls using a PCB other than the first one used receive an FH status code. You can use the NOPROCH keyword on the SETO statement to alleviate this restriction.

H is used in conjunction with A, G, I, R, and D.

If you do not specify the PROCOPT parameter, it defaults to PROCOPT=A. The replace and delete functions also imply the Get function.

A user abend (U8XX) from the retrieve module (DFSDCR00) can occur with PROCOPT=GO if another program updates pointers when this program is following the pointers. A U0800 or U0852 abend can also occur in the VLEXP routine, or in the retrieve module, if an invalid compressed segment is detected. Pointers are updated during the insert and delete functions and during replacement of a variable-length segment. To reduce the number of abends of this type, code the PROCOPT= parameter with an N or a T.

Notes:

1. If any PCBs in the PSB have a PROCOPT of L or LS and either explicitly reference HISAM or HIDAM databases, or implicitly reference INDEX databases, no other PCB in the same PSB can reference any of the databases listed, either explicitly or implicitly, with a PROCOPT other than L or LS. If any PCB in the PSB has a PROCOPT of L or LS and explicitly references a PHIDAM database, no other PCB in the same PSB can reference the PHIDAM database with a PROCOPT of L or LS. The SENSEG statements within that PCB should not contain INDICES= operands.
2. If L is specified for a PCB that references a database with multiple data set groups, the PCB should include at least one SENSEG statement for each data set group in the database.
3. When the first ISRT call is issued using a PCB with PROCOPT=L, and the database is using VSAM, the VSAM data set must be empty. If it is not empty, an open error will result.

   Recommendation: If the database is using OSAM, it is recommended that the data set be a newly allocated empty data set.

   If the data set is not empty, the load will start at the front of the data set, writing over the existing data.
4. If the 'O' option is used for a PCB, the SENSEG statement must not specify a PROCOPT of I, R, D, or A.
5. An online application program always has exclusive use of the SHSAM or HSAM databases, which are referenced by PCBs in its PSB. No other application programs can be concurrently scheduled to access those same SHSAM or HSAM databases in an online environment.
6. If the Online Database Image Copy utility refers to this PCB, the value of PROCOPT= L or LS is invalid. If the database to be copied is the index portion of a HIDAM or PHIDAM database, only PROCOPT=G and PROCOPT=GO are valid. If PROCOPT=E is specified, the Online Image Copy utility will execute with exclusive control of the database, even though the utility does not require the control.
7. If the Database Surveyor utility feature refers to this PCB, you must specify PROCOPT=G.
8. In the case of concatenated segments, the PROCOPT= parameter governs the logical child segment of the concatenated segment. The logical parent of the concatenated segment is governed by the RULES= parameter of the SEGM statement.
9. PROCOPT=E only applies to the database specified in the PCB. To enable exclusive use of a secondary index not explicitly used by the application, add another PCB with PROCOPT=E for the secondary index database.

Use of PROCOPT=(with Fast Path)

In a non-terminal-related or fixed terminal-related MSDB, only the processing options G and R are valid.

G Get function.

R Replace function. Includes G.

In a dynamic terminal-related MSDB, the processing options G, I, R, D, A or any combination of G, I, R, and D are valid.

G Get function.

I Insert function.

R Replace function. Includes G.

D Delete function. Includes G.

A All. Includes functions G, I, R and D.

In a DEDB, the processing options G, I, R, D, A, P, N, T, O, and H are valid.

G Get function.

I Insert function.

R Replace function. Includes G.

D Delete function. Includes G.

A All. Includes functions G, I, R, and D.

P Position function. Is not required if command code D is used when processing DEDBs. It is only valid for a batch message program (BMP). If this option is specified for another type of region, such as an IFP region, it will be ignored. With this option, a GC status code is returned when a UOW boundary is crossed during a `G(H)U`, `G(H)N`, or `ISRT` on a root segment. Also, database positioning is maintained across a valid SYNC call and a blank status code is returned when the sync is issued immediately after receiving a GC status code. In the case of a sync process failure or ROLB call, position is set to the last valid sync point or, if no valid sync point exists, to the start of the database. A SYNC or ROLB call without a preceding GC status will also cause position to be set to the start of the database.

Related Reading: For more information about the P processing option or the UOW for DEDBs, see *IMS Version 9: Administration Guide: Database Manager*.

If you use the D command code in a call to a DEDB, the P processing option need not be specified in the PCB for the program.

N Reduces the number of abends that read-only application programs are subject to. Read-only application programs can reference data being updated by another application program. When this happens, invalid pointer to the data might exist. If an invalid pointer is detected, the read-only application program abends. By specifying N, you avoid this. A GG status code is returned to the program, instead. The program can then terminate processing, continue processing by reading a different segment, or access the data using a different path. N must be specified as `GON`, `GONH`, or `GONP`.

O Read only; do not enqueue to check availability. Selecting `PROCOPT=GO`, `GON`, or `GOT` for DEDBs indicates that read without integrity is in effect. No locking mechanism is used to maintain the integrity of the retrieved data. O must be specified as `GO`, `GON`, or `GOT`, and may not be used in conjunction with H.

A user abend (U1026) can occur with PROCOPT=GO if another program updates pointers when this program is following the pointers. Another

example of the abend U1026 is if this program rereads a segment that has moved when another program changes its length. The following examples will help illustrate instances where abend U1026 could occur or old data is retrieved.

Example 1: If one region uses both update and PROCOPT=GO PCBs to update and read the same segment, the following scenario will not produce a pointer error to the control blocks of the PROCOPT=GO PCB (MLTE). Call the update PCB (PCBA), and the read PCB (PCBGO).

1. Region 1 PCBGO reads the CI and sets the position of the segment in MLTE. The data in the buffer is linked to EPSTGOBF.
2. Region 1 issues a call to update the segment. Region 1 PCBA steals the buffer off its EPSTGOBF. Region 1 PCBA saves the old position and updates the segment. Even if the segment is moved, Region 1 will update the PCBGO MLTE because the position in the GO MLTE matches the saved old position.
3. Region 1 PCBGO references the segment again and retrieves the updated segment.

Example 2: When two regions update the same segment and use both update and PROCOPT=GO PCBs, the following scenario will not produce a pointer error to the control blocks of the PROCOPT=GO PCB (MLTE), but the PROCOPT=GO PCB will not have access to the updated segment from the other region.

1. Region 1 PCBGO reads the CI and sets the position of the segment in MLTE. The buffer is linked to EPSTGOBF.
2. Region 2 PCBA reads the CI with lock and replaces the segment with a length change. The position of the segment changes, resulting in an FSE in the updated CI at the position set in Region 1 PCBGO MLTE. Region 1 still has the old data in the buffer which is linked to EPSTGOBF.
3. Region 1 PCBGO references the segment again and retrieves the old segment because its buffer has not been updated by Region 2's change.

Example 3: When two regions update the same segment and use both update and PROCOPT=GO PCBs, the following scenario will not produce a pointer error to the control blocks of the PROCOPT=GO PCB (MLTE), but the PROCOPT=GO PCB will not have access to the updated segment from its own region.

1. Region 1 PCBGO reads the CI and sets the position of the segment in MLTE. The buffer is linked to EPSTGOBF.
2. Region 2 PCBA reads the CI with lock and replaces the segment with a length change. The position of the segment changes, resulting in an FSE in the updated CI at the position set in Region 1 PCBGO MLTE. Region 1 still has the old data in the buffer which is linked to EPSTGOBF.
3. Region 1 issues a call to update the segment. Region 1 waits for the release of Region 2's lock. Because the updated segment is now on a different block, Region 1 does not find the duplicate buffer on EPSTGOBF and the old buffer is still linked to EPSTGOBF. Region 1 reads the update CI, which is now in its buffer. Region 1 PCBA updates the segment in its place. Even if the segment is moved, Region 1 will not update the PCBGO MLTE because the position in the MLTE no

longer matches the position of the segment. There are now two duplicate buffers, one containing the old data that is linked to EPSTGOBF, and another containing updated information that is linked to EPSTXCOC.

4. Region 1 PCBGO references the segment and retrieves the old data.

Example 4: When two regions update the same segment and use both update and PROCOPT=GO PCBs, the following scenario will produce a pointer error to the control blocks of the PROCOPT=GO PCB (MLTE).

1. Region 1 PCBGO reads the CI and sets the position of the segment in MLTE. The buffer is linked to EPSTGOBF.
2. Region 2 PCBA reads the CI with lock and replaces the segment with a length change. The position of the segment changes within the same block and creates an FSE in the updated CI at the position set in Region 1 PCBGO MLTE. Region 1 still has the old data in the buffer linked to EPSTGOBF.
3. Region 1 issues a call to update the segment. Region 1 waits for the release of Region 2's lock. Region 1 PCBA steals the buffer off EPSTGOBF and reads the updated CI, moving it to Region 1's buffer. Region 1 PCBA updates the segment in its place. Even if the segment is moved, Region 1 will not update the PCBGO MLTE because the position in the MLTE no longer matches the position of the segment.
4. Region 1 PCBGO references the segment again and receives abend U1026 since there is now an FSE where the segment had been (MLTE's position).

To reduce the number of abends of this type, code the PROCOPT= parameter with an N or a T.

T Works exactly like the N option. T must be specified as GOT, GOTH, or GOTP.

H HSSP. Includes G and P.

A DLET or ISRT call to a terminal-related dynamic MSDB from a program with no input LTERM present, for example, a batch-oriented BMP, will result in a status code of AM, regardless of the processing options specified.

The Replace function also implies the Get function. If the referenced segment is a root or direct dependent segment, A implies G, I, R, and D. Only processing options of G, I, and GI are valid for sequential dependent segments.

The processing option of P is valid only when specified for a root segment to be used by an IMS batch message program. If the processing option P is specified for another type of region, such as an IFP region, it will be ignored. With this option, a GC status code is returned when a UOW boundary is crossed during a G(H)U, G(H)N, or ISRT on a root segment. Also, database positioning is maintained across a valid SYNC call and a blank status code is returned when the sync is issued immediately after receiving a GC status code. In the case of a sync process failure or ROLB call, position is set to the last valid sync point or, if no valid sync point exists, to the start of the database. A SYNC or ROLB call without a preceding GC status will also cause position to be set to the start of the database.

Related Reading: For more information on the P processing option or the UOW for DEDBs, see *IMS Version 9: Administration Guide: Database Manager*.

If you use the D command code in a call to a DEDB, the P processing option need not be specified in the PCB for the program.

Procopt H may not be used in conjunction with O.

If you specify invalid processing options, the PSBGEN accepts them but the Application Control Blocks Maintenance utility fails. The error does not appear in the PSBGEN but appears in the ACBGEN.

SB=

Specifies which PCBs will be buffered using sequential buffering (SB). This is an optional parameter. The default is SB=NO, unless the default option has been modified for Batch and BMPs by the DFSSBUX0 to SB=COND.

Related Reading: For more information about DFSSBUX0, see *IMS Version 9: Customization Guide*.

COND Specifies that SB should be activated conditionally. IMS will monitor statistics about the I/O reference pattern of this PCB to the DB data set. If IMS detects a sequential I/O reference pattern and a reasonable activity rate, it will activate SB and acquire the required buffers.

NO Specifies that SB should not be used for this DB PCB.

Recommendation: For short-running MPPs, Fast Path programs, and CICS™ programs, either omit the SB= keyword or specify SB=NO.

KEYLEN=

The value specified in bytes of the longest concatenated key for a hierarchic path of sensitive segments that the application program uses in the logical data structure. Figure 32 on page 128 shows an IMS database that contains segments A- H plus segment J. Segments A, B, C, D, F, and J each have a key field length of 10 bytes. Segment E has a key field length of 250 bytes. Segment G has a key field length of 40 bytes. And Segment H has a key field length of 50 bytes. Table 11 shows how the KEYLEN= will be specified.

Table 11. How A KEYLEN Is Determined

Database Hierarchical Paths	Concatenated Key Length Paths
A+B+C=	30 bytes
A+B+D=	30 bytes
A+E=	260 bytes
A+F+G+H+J=	120 bytes
A KEYLEN=260 bytes would be specified	

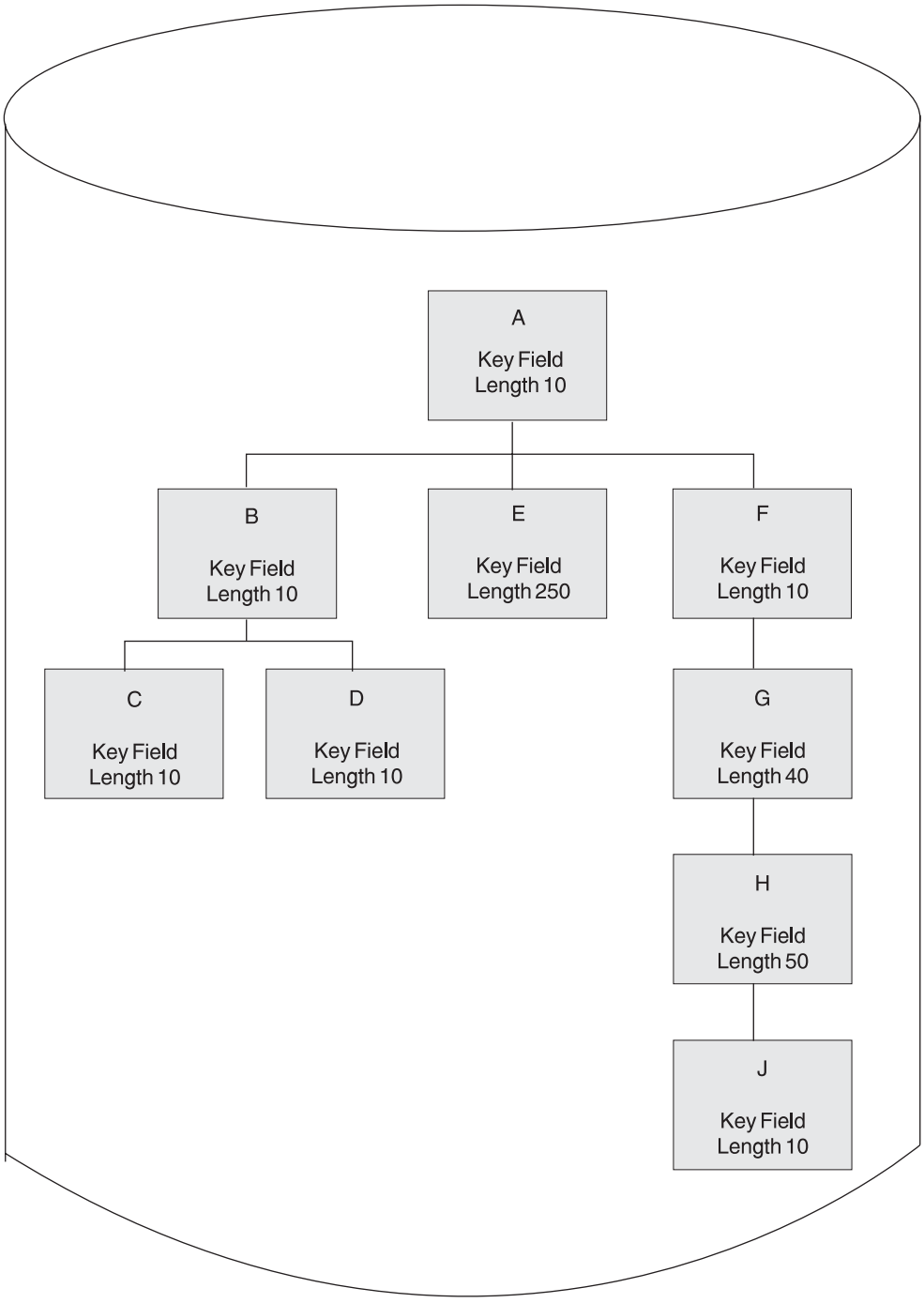


Figure 32. KEYLEN Definition

For a non-terminal-related MSDB without terminal-related keys, the value must be greater than or equal to the value of the BYTES parameter of the sequence field in the DBD generation and be from 1 to 240 bytes.

For a terminal-related MSDB (using the LTERM name as a key), this value must be 8.

POS=

Specifies single or multiple positioning for the logical data structure. Single or multiple positioning provides a functional variation in the call.

Related Reading: Refer to *IMS Version 9: Application Programming: EXEC DLI Commands for CICS and IMS* and *IMS Version 9: Application Programming: Database Manager* for the functional difference.

The performance variation between single and multiple positioning is insignificant. HSAM does not support multiple positioning.

POS=SINGLE or S is the default.

Exception: For DEDBs having more than two dependent segments, the default is POS=MULTPLE or M.

Coding a POS value on the PCB statement for a DEDB will **not** override the default that is selected based on the number of dependent segments.

PROCSEQ=

Specifies the name of a secondary index that is used to process the database named in the DBDNAME parameter through a secondary processing sequence. The parameter is optional. It is valid only if a secondary index exists for this database. If this parameter is used, subsequent SENSEG statements must reflect the secondary processing sequence hierarchy of segment types in the indexed data base. For example, the first SENSEG statement must name the indexed segment with a PARENT=0 parameter.

index dbname must be the name of a secondary index DBD.

For a secondary processing sequence, processing options L and LS are invalid. Inserting and deleting the index target segment and any of its inverted parents are not allowed. When the blocks are built, if the processing option for these segments includes I or D, a warning message indicates that the processing option has been changed to reflect this restriction.

VIEW=MSDB

Is used to specify the MSDB commit view. Your existing applications can use either MSDB commit view or the default DEDB commit view. To use the MSDB commit view for DEDBs, specify `VIEW=MSDB` on the statement. If you do not specify `VIEW=MSDB`, the DEDB will use the DEDB commit view. No changes to any existing application programs are required to migrate your MSDBs to DEDBs.

If you issue a REPL call with a PCB that specifies `VIEW=MSDB`, the segment must have a key. This includes any segment in a path if command code 'D' is specified. Otherwise, status AM is returned.

For more information on the `VIEW=MSDB` parameter see *IMS Version 9: Administration Guide: Database Manager*.

LIST=

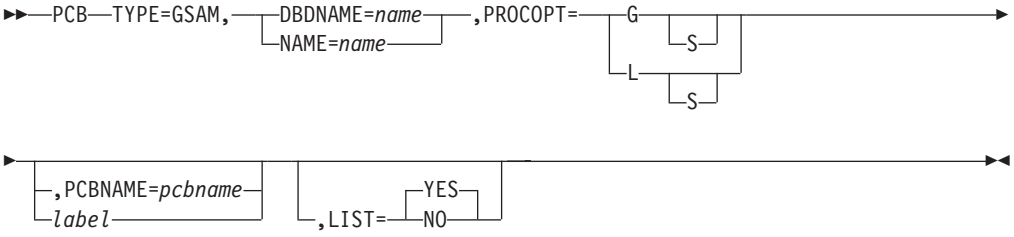
Specifies whether the named PCB is included in the PCB list passed to the application program at entry. Specify YES to include a named PCB in the PCB list. Specify NO to exclude a named PCB from the PCB list. YES is the default.

To exclude a PCB from the PCB list, you must assign the PCB a name with either the label or PCBNAME= parameter. You can specify LIST=NO if an application program does not need a PCB's address.

See page119 for information about naming PCBs on the DL/I database PCB statement.

GSAM PCB Statement

The following diagram shows the format for the GSAM database PCB statement.



TYPE=GSAM
Is a required keyword parameter for all GSAM database PCBs that will be allocated and processed in the dependent region.

DBDNAME= or NAME=
Is a required keyword parameter for the name that specifies the GSAM DBD to be used as the primary source of data set description. SENSEG statements must not follow this PCB statement.

PROCOPT=
Is a required parameter for the processing options on the data set declared in this PCB that can be used in an associated application program. Use the following characters to specify the parameter.

G Get function.

L Load function.

S Large-scale sequential activity. Use GSAM multiple-buffering option (BUFFIO).

The GSAM PCB statement must follow the PCB statements with TYPE=TP or DB if any exist in the PSB generation. The rule is:

TP PCBs First

DB PCBs Second

GSAM PCBs Last

PCBNAME=
Specifies the name of the PCB. The PCB name must be an alphanumeric, 8-byte character string that follows standard naming conventions. The PCB name must be unique within the PSB.

Exception: Do not specify this parameter if the PCB statement includes *label*.

label
Specifies an 1- to 8-character alphanumeric label that is valid for an assembler language statement. The labels for the PCB statements within a PSB must be unique.

Exception: Do not specify this parameter if PCBNAME= is used.

LIST=
Specifies whether the named PCB is included in the PCB list passed to the application program at entry. Specify YES to include a named PCB in the PCB list. Specify NO to exclude a named PCB from the PCB list. YES is the default.

To exclude a PCB from the PCB list, you must assign the PCB a name with the PCBNAME= parameter. You can specify LIST=NO if an application program does not need a PCB's address.

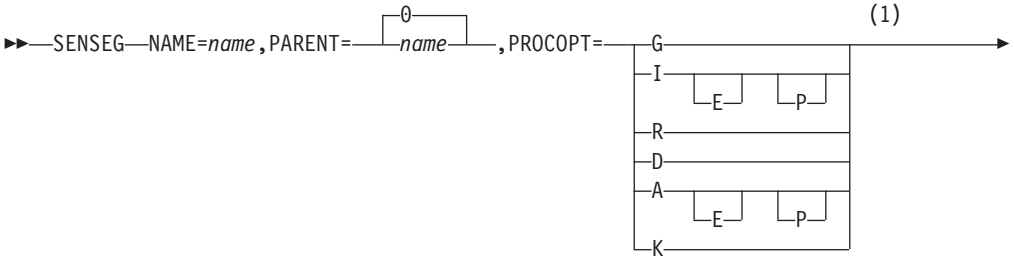
SENSEG Statement

You use the SENSEG statement with the database PCB statement to define a hierarchically related set of data segments. This set represents segments to which a program through this PCB is sensitive. This segment set can physically exist in one database or can be derived from several physical databases. One or more SENSEG PCB statements can be included; each PCB statement must immediately follow the PCB statement to which it is related. There must be one SENSEG statement for each segment to which the application program is sensitive. All segments in the hierarchic path to any required segment must be specified. A maximum of 30,000 SENSEG statements can be defined in a single PSB generation. 30,000 SENSEG statements are impractical because this many SENSEG statements will require more storage than is usually available.

The order in which SENSEG statements are sequenced after a PCB statement determines the logical access order for the segments. When using HSAM or HISAM databases, the SENSEG statement sequence must follow the physical sequence of the segments as defined in DBDGEN, unless the PROCSEQ parameter is used in the PCB statement.

If the PROCSEQ parameter is used in the PCB statement, the SENSEG statement sequence reflects the secondary processing sequence specified by the PROCSEQ parameter. For HDAM, HIDAM, PHDAM, and PHIDAM databases, the SENSEG statements for segments on the same level do not have to be in the same order as the DBD. The order of dependent segments whose parent segment does not use hierarchic pointing can differ from the physical sequence.

The format of the SENSEG statement is as follows:



Notes:

1 These can be selected in any combination; if G, I, R, and D are all chosen, use A instead (A = G, I, R, and D combined).

NAME=
Is the name of the segment type as defined through a SEGM statement during DBD generation. The field is from 1- to 8-alphanumeric characters.

PARENT=

Is the segment type name of this segment's parent.

Requirement: This parameter is required for all dependent segments.

The field is either from 1- to 8-alphanumeric characters or 0. If this SENSEG statement defines a root segment type as being sensitive, this parameter must equal zero. PARENT=0 is the default.

PROCOPT=

Indicates the processing options valid for use of this sensitive segment by an associated application program. This parameter has the same meaning as the PROCOPT= parameter on the PCB statement. In addition to the valid options for this parameter listed in "DL/I or Fast Path Database PCB Statement" on page 119, an option can be used on the SENSEG statement which does not apply to the PCB statement. A PROCOPT of K indicates key sensitivity only. A `GN` call with no SSAs can access only data-sensitive segments. If a key-sensitive segment is designated for retrieval in an SSA, the segment is not moved to the user's I/O area. The key is placed at the appropriate offset in the key feedback area of the PCB. If this PROCOPT= parameter is not specified, the PCB PROCOPT parameter is used as default. If there is a difference in the processing options specified on the PCB and SENSEG statements and the options are compatible, SENSEG PROCOPT overrides the PCB PROCOPT. If PROCOPT= L or LS is specified on the preceding PCB statement, this parameter must be omitted.

Do not specify a SENSEG statement for a virtual logical child segment type if PROCOPT= L or LS is specified. The Replace and Delete functions also imply the Get function.

If a segment has PROCOPT=K specified, an unqualified Get Next call (`GN`) skips to the next sensitive segment with a PROCOPT other than K.

The SENSEG PROCOPT overrides the PCB PROCOPT. If PROCOPT=E is specified in the PCB, the SENSEG PROCOPT must also specify E if it is intended to schedule exclusively for that SENSEG.

It is not valid to code the N or T processing option in the SENSEG statement. You can code them only in the PCB statement.

The processing option for a DEDB sequential dependent segment must be either G or I. If one of these values is not specified on the PCB statement, PROCOPT=G or I must be specified on the SENSEG PCB statement.

In the case of concatenated segments, the PROCOPT= parameter governs the logical child segment of the concatenated segment. The logical parent of the concatenated segment is governed by the RULES= parameter of the SEGM PCB statement.

SSPTR=

Specifies the subset pointer number and the sensitivity for the pointer. Up to 8 subset pointers can be defined. The subset pointer number (the first parameter) must be 1 through 8. The sensitivity for the pointer (the second parameter) must be R (read sensitive) or U (update). If the first parameter and the second parameter are not specified, the pointer has no sensitivity. If only n is specified, the pointer is read sensitive. SSPTR=R is the default.

You cannot use U (update sensitivity) if the processing option is not A, R, I, or D.

INDICES=

Specifies which secondary indexes contain search fields that are used to qualify

SSAs for an indexed segment type. The INDICES= parameter can be specified for indexed segment types only. It enables SSAs of calls for the indexed segment type to be qualified on the search field of the index segment type contained in each secondary index specified.

Restriction: An SSA of a call for an indexed segment type cannot be qualified on the search field of a secondary index unless that secondary index was specified in the INDICES= parameter of the SENSEG statement for the indexed segment type or in the PROCSEQ= parameter of the PCB statement.

For *list1*, you can specify up to 32 DBD names of secondary indexes. If two or more names are specified, these names must be separated by commas and the list enclosed in parentheses.

Figure 33 shows the data structure of segment definition and includes segments A-F.

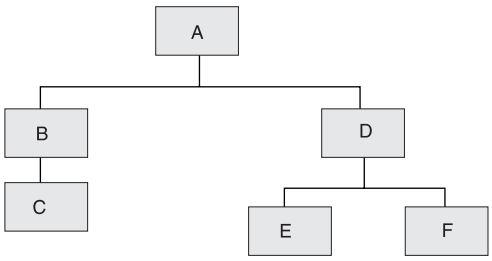


Figure 33. Data Structure of Segment Definition

All of these segments are defined within one DBD. Do not specify INDICES= on a SENSEG PCB statement if you specified PROCOPT=L, LS, I, or D on the preceding PCB statement.

The complete PCB and SENSEG statements for the data structure might be written as follows:

```
Col. 10         Col. 16                          Col. 72.

PCB             TYPE=DB,DBDNAME=DATABASE,        X
                PROCOPT=A,KEYLEN=22
SENSEG          NAME=A,PARENT=0,PROCOPT=G
SENSEG          NAME=B,PARENT=A,PROCOPT=G
SENSEG          NAME=C,PARENT=B,PROCOPT=I
SENSEG          NAME=D,PARENT=A,PROCOPT=A
SENSEG          NAME=E,PARENT=D,PROCOPT=G
SENSEG          NAME=F,PARENT=D,PROCOPT=A
```

SENFLD Statement

The SENFLD statement is used with the SENSEG statement to indicate those fields within a segment to which an application program is sensitive. One or more SENFLD statements can be included. Each statement must follow the SENSEG statement to which it is related. You can define a maximum of 255 SENFLD statements for a given SENSEG statement. You can define a maximum of 10,000 SENFLD statements in a single PSB generation.

The same field can be referenced in more than one SENFLD statement within a SENSEG. If the duplicate field names participate in a concatenated segment and the same field name appears in both portions of the concatenation, the first

reference will be to the logical child, and all subsequent references will be to the logical parent. This referencing sequence determines the order in which fields will be moved to the user's I/O area.

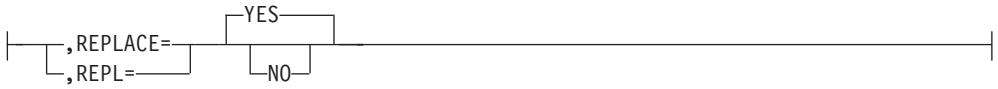
For retrieve-only processing you can request, using the SENFLD statement, that the same data be moved to multiple locations in your I/O area, provided that no overlapping occurs, and that SENFLDs of variable-length segments are of the same type.

The following restrictions apply to the SENFLD statement:

- The length field of a variable-length segment cannot be referenced through a SENFLD statement.
- A SENFLD statement cannot appear within a SENSEG with PROCOPT=K.
- A SENFLD statement cannot not appear within a SENSEG with PROCOPT=I or L, if the SENSEG refers to a logical child segment.
- If SENFLD statements are used within a SENSEG with PROCOPT=I or L, a SENFLD statement must be included for the segment sequence field, if it exists.
- This statement is not supported for MSDB and DEDB.

The format of the SENFLD statement is as follows:

A:



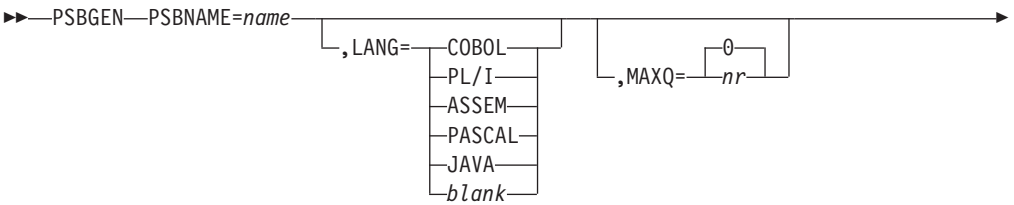
NAME=
Is the name of this field as defined through a FIELD statement during DBD generation. The field is from 1- to 8-alphanumeric characters.

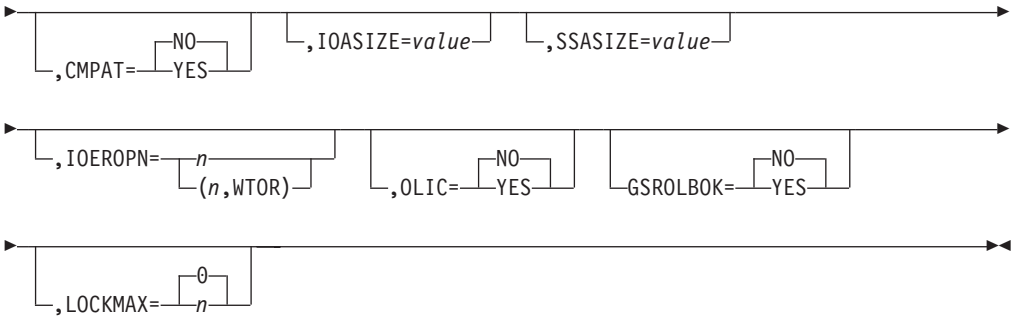
START=
Specifies the starting position of this field relative to the beginning of the segment within the user's I/O area. *startpos* for the first byte of a segment is 1. *startpos* must be a decimal number whose value does not exceed 32767.

REPLACE= or REPL=
Specifies whether or not this field can be altered on a replace call. You can specify NO or N. If omitted, REPLACE=YES (or Y) is the default.

PSBGEN Statement

The PSBGEN statement specifies characteristics of the application program. The following syntax diagram shows the format for the PSBGEN statement.





PSBNAME=

Specifies the parameter for the alphanumeric name of this PSB. The PSBNAME name must be an alphanumeric, 8-byte character string that follows standard naming conventions. This name becomes the load module name for the PSB in the library IMS.PSBLIB. If the program is to run in a message processing region, this name must be the same as the program load module name in the program library called IMS.PGMLIB No special characters can be used in the name.

Do not give a DBD the same name as an existing PSB. Using an existing name can cause unpredictable results: an error will occur at ACB generation time.

LANG=

An optional keyword that indicates the compiler language in which the message processing or batch processing program is written. The value for this parameter must be COBOL, PL/I, ASSEM, PASCAL, JAVA, or blank. Leave the value blank if the application has been enabled for the IBM Language Environment® for z/OS & VM. If you specify OLIC=YES, LANG=PL/I is invalid. If your application program is written in C language, specify LANG=ASSEM.

CICS and the IBM Language Environment for z/OS & VM do not support PASCAL.

You must specify LANG=JAVA for any PSBs associated with a JMP type IMS Java application.

If you are using IMS PL/I applications that run in a compatibility mode using the PLICALLA entry point, you must specify LANG=PLI on the PSBGEN. If you change the entry point and add SYSTEM(IMS) to the EXEC PARM of the compile step, you can specify LANG=blank or LANG=PLI on the PSBGEN. Table 12 shows when to use LANG=blank and LANG=PLI.

Table 12. Using LANG= Option in an LE/370 Environment for PL/I Compatibility

Compile exec statement is PARM=(...,SYSTEM(IMS)...	and entry point name is PLICALLA	Then LANG= is as follows:
Yes	Yes	LANG=PLI
Yes	No	LANG=blank or LANG=PLI
No	No	**Note:** Not valid for IMS PL/I applications
No	Yes	LANG=PLI

PLICALLA is only valid for PL/I compatibility support in an LE/370 environment. If a PL/I application using PLICALLA entry at link-edit time is link-edited using LE/370 with the PLICALLA entry, the link-edit will work; however, you must use

LANG=PLI. If the application is re-compiled using PL/I MVS & VM Version 1 Release 1, and link-edited using LE/370 Version 1 Release 2, the link-edit will fail. You must remove the PLICALLA entry statement from the link-edit.

MAXQ=
Is the maximum number of database calls with Qx command codes that can be issued between synchronization points. If this number is exceeded, the application program will abend. The default value is zero.

CMPAT=
Provides compatibility between BMP or MSG and Batch-DL/I parameter lists. If CMPAT=YES, the PSB is always treated as if there were an I/O PCB, no matter how it is used. If CMPAT=NO, the PSB has an I/O PCB added only for BMP or MSG regions. The default is NO.

IOASIZE=
Specifies the size of the largest I/O area used by the application program. The size specification is used to determine the amount of main storage reserved in the PSB pool to hold the control region's copy of the user's I/O area data during scheduling of this application program. If you do not specify this value, the ACB utility program calculates a maximum I/O area size and uses it as a default. The size calculated is the total length of all sensitive segments in the longest possible path call. (The total length of the segment must be used, even if the application program is not sensitive to all fields in a segment.) The value specified is in bytes, with a maximum of 256000. However, the combined length of all concatenated segments to be returned to the application on a single path call must not exceed 65535 bytes.

If the PSB contains any field sensitive segments, and IOASIZE is specified, the specified value is used only if it is larger than the OASIZE calculated by the ACBGEN utility. The value of the IOASIZE that will be used is indicated in message DFS0593I issued by ACB generation. The major components of this pool requirement are IOASIZE and SSASIZE. When the PSB is built into ACBLIB, ACB generation message DFS0589I indicates the PSB's total work pool space requirement.

If STAT calls or the test program (DFSDDLT0) is used with this PSB, IOASIZE must be greater than 600 bytes.

If CMD or GCMD calls (from automated operator interface application programs) are used with this PSB, IOASIZE must be at least 132 bytes.

If extended checkpoint/restart is used, IOASIZE must be set to a value equal to or greater than the larger of the following:

- I/O area needed to receive data from a GU call issued during restart, while repositioning DL/I databases that were checkpointed (if this PSB contains any).
- Largest LRECL used in a GSAM data set that is checkpointed.

Either the value pointed to by the third parameter (I/O AREA LEN) of the XRST CALL or the value of this parameter will be used, depending on which value is larger.

SSASIZE=
Specifies the maximum total length of all SSAs used by the application program. IMS uses the size specification to determine the amount of main storage reserved in the PSB work pool to hold a copy of the user's SSA strings during execution of this application program. If you do not specify this value, the ACB utility program calculates a maximum SSA size to be used as a default.

The size calculated is the maximum number of levels in any PCB within this PSB multiplied by 280. The value specified is in bytes, with a maximum of 256000.

Restriction: When you run IMS under CICS without DBCTL, the PSB work pool requirement cannot exceed 64KB.

The major components of this pool requirement are IOASIZE and SSASIZE. When the PSB is built into ACBLIB, ACB generation message DFS0589I indicates the PSB's total work pool space requirement.

IOEROPN=

Is applicable only in batch-type regions (DLI or DBB). This parameter is not valid for CICS. The *n* subparameter is the condition code returned to the operating system when IMS terminates normally and one or more input or output errors occurred on any database during the application program execution. The *n* subparameter is a number from 0 to 4095.

If n=451, IMS terminates with a U451 abend instead of passing a condition code to the operating system. If n=451 and the IMS or the application program abends with an abend other than U451, and an I/O error has also occurred, a write-to-programmer of message DFS0426I is issued. This message indicates that an I/O error has occurred during execution and that a U451 abend has occurred if the actual abend has not.

If you specify the WTOR subparameter, a WTOR for the DFS0451A I/O error message is issued, and DL/I waits for the operator to respond before continuing. If you respond `ABEND`, IMS terminates with a U0451 abend. If you respond `CONT` IMS continues. Any other response causes the DFS0451A message to be reissued.

If n=451, IMS terminates with abend U0451, even if the operator responds "CONT" to the DFS0451A message.

By using the IOEROPN parameter, you can set a unique JCL condition code when an I/O error occurs and test the condition code in subsequent job steps. If you do not specify this parameter, the return code passed from the application program is passed to the operating system and status codes and console messages are the only indications of database I/O errors.

If you code the WTOR subparameter, you must code the *n* subparameter and parentheses are required. If you code only IOEROPN=n, parentheses are not required.

OLIC=

Indicates whether the user of this PSB is authorized to execute the Online Database Image Copy utility or the Surveyor utility feature that runs as a BMP against a database named in this PSB. YES allows the Online Image Copy and the Surveyor utility feature; NO prohibits the Online Image Copy and the Surveyor utility feature. NO is the default. This parameter is invalid if any DBPCB (TYPE=DB) specifies PROCOPT=L or LS.

Exception: This parameter is not applicable to CICS, GSAM, HSAM, MSDB, or DEDB databases.

GSROLBOK=

Controls whether an internal ROLB call should be done to roll back non-GSAM database updates when:

- The application is a non-message-driven BMP.
- The PSB contains a GSAM PCB.
- DB2 reports a deadlock either on a thread create or on an SQL call.

YES means that the internal ROLB call should be done and that the SQL code regarding the deadlock should be returned to the application program. *NO* means that the internal ROLB call should not be not done and that a user abend 777 should occur. If the GSROLBOK parameter is omitted, the default is *NO*.

LOCKMAX=
Indicates the maximum number of locks an application program can get at one time. *n* is a numeric value between 0 and 255. *n* is specified in units of 1000. For example, a specification of LOCKMAX=5 indicates a maximum of 5000 locks at one time.

The default value is 0. This indicates that there is no maximum number of locks that are allowed at one time.

If an application program runs for an extended time without committing, the locking done by IMS of database records and changes can accumulate. You can use the LOCKMAX parameter to prevent a single application program from consuming all locking storage and thereby causing other programs to abend.

You can override the LOCKMAX value specified on the PSBGEN statement at program execution by specifying LOCKMAX=0 (to turn off limit completely) or by specifying LOCKMAX=1 to 32767 on the dependent region (BMP, MPP, or IFP) or Batch (DBB or DLI). The value is in units of 1000. You can use this method to exceed the maximum value of 255 that can be specified on the PSBGEN statement LOCKMAX parameter.

There can be several PCB statements for message output and several PCB statements for databases, but only one PSBGEN in a PSB generation PCB statement deck. The PSBGEN statement must be the last statement in the deck preceding the END statement.

END Statement

All PSB generation utility control statements must be followed by an END statement.

Requirement: The END statement is required by the macro assembler to indicate the end of the assembly data.

Output Messages and Statistics for PSB Generation

PSB generation produces three types of printed output and one load module, which becomes a member of the partitioned data set, IMS.PSBLIB. The types of output are:

Control Statement Listing
This is a listing of the input statement images to this job step.

Diagnostics
Errors discovered during the processing of control statement result in diagnostic messages being printed immediately following the image of the last control statement read before the error was discovered. The message can either refer to the control statement immediately preceding it or the preceding group of control statements. It is also possible for more than one message to be printed for each control statement. In this case, they follow each other on the output listing. After all the control statements have been read, a further check is made of the logic of the entire deck. This can result in one or more additional diagnostic messages.

If an error is discovered, a diagnostic message is printed, the control statements are listed, and the other outputs are suppressed. However, all the control statements are read and checked before the PSB generation execution is terminated. The link-edit step of PSB generation is not executed if a control statement error has been found.

Assembler Listing
Except when PRINT NOGEN is specified, an operating system assembler language listing of the PSB created by PSB generation execution is provided.

Load Module
PSB generation is a two-step operating system job. Step 1 is a macro assembly execution that produces an object module. Step 2 is a link-edit of the object module, which produces a load module that becomes a member of IMS.PSBLIB.

PSB Generation Error Conditions
See *IMS Version 9: Messages and Codes, Volume 1* for a complete description of the IMS messages that indicate PSB errors.

PSB Examples

This section includes examples of the use of the PSBGEN utility.

Examples of PSB Generation

This example shows a PSB generation for a message processing program to process the hierarchic data structure shown in Figure 34. The data structure contains segments: PARTMAST, CPWS, POLN, OPERTON, INVSTAT, and OPERSGMT.

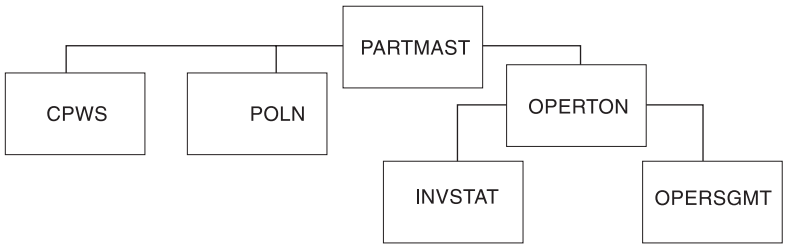


Figure 34. Sample Hierarchic Data Structure

Example 1

This example shows output messages that are to be transmitted to logical terminals OUTPUT1 and OUTPUT2 as well as the terminal representing the source of input.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PSBGEN,MBR=APPLPGM1
//C.SYSIN   DD   *

        PCB    TYPE=TP,NAME=OUTPUT1,PCBNAME=OUTPCB1
        PCB    TYPE=TP,NAME=OUTPUT2,PCBNAME=OUTPCB2
        PCB    TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=A,KEYLEN=100
        SENSEG NAME=PARTMAST,PARENT=0,PROCOPT=A
        SENSEG NAME=CPWS,PARENT=PARTMAST,PROCOPT=A
        SENSEG NAME=POLN,PARENT=PARTMAST,PROCOPT=A
        SENSEG NAME=OPERTON,PARENT=PARTMAST,PROCOPT=A
        SENSEG NAME=INVSTAT,PARENT=OPERTON,PROCOPT=A
```

```
       SENSEG NAME=OPERSGMT,PARENT=OPERTON
       PSBGEN LANG=COBOL,PSBNAME=APPLPGM1
       END
/*
```

Example 2

This example shows these statements being used for a batch program, where programs using this PSB do not reference the telecommunications PCBs in the batch environment.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PSBGEN,MBR=APPLPGM2
//C.SYSIN   DD   *

       PCB    TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=A,KEYLEN=100
       SENSEG NAME=PARTMAST,PARENT=0,PROCOPT=A
       SENSEG NAME=CPWS,PARENT=PARTMAST,PROCOPT=A
       SENSEG NAME=POLN,PARENT=PARTMAST,PROCOPT=A
       SENSEG NAME=OPERTON,PARENT=PARTMAST,PROCOPT=A
       SENSEG NAME=INVSTAT,PARENT=OPERTON,PROCOPT=A
       SENSEG NAME=OPERSGMT,PARENT=OPERTON
       PSBGEN LANG=COBOL,PSBNAME=APPLPGM2
       END
/*
```

Example 3

This example shows that a PSB generation is being performed for a batch message processing program. The GSAM PCB is used by the application program to generate a report file.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PSBGEN,MBR=APPLPGM3
//C.SYSIN   DD   *

       PCB    TYPE=TP,NAME=OUTPUT1
       PCB    TYPE=TP,NAME=OUTPUT2
       PCB    TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=A,KEYLEN=100
       SENSEG NAME=PARTMAST,PARENT=0,PROCOPT=A
       SENSEG NAME=CPWS,PARENT=PARTMAST,PROCOPT=A
       PCB    TYPE=GSAM,DBDNAME=REPORT,PROCOPT=LS
       PSBGEN LANG=COBOL,PSBNAME=APPLPGM3
       END
/*
```

Example 4

This example shows that a PSB generation is being performed for a batch program. The PCB has been named (PRTMASTR). The PCB name is used on DLI calls that use the AIBTDLI interface.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PSBGEN,MBR=APPLPGM4
//C.SYSIN   DD   *

 PCB    TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=A,KEYLEN=100,PCBNAME=PARTMSTR
 SENSEG NAME=PARTMAST,PARENT=0,PROCOPT=A
 SENSEG NAME=CPWS,PARENT=PARTMAST,PROCOPT=A
 SENSEG NAME=POLN,PARENT=PARTMAST,PROCOPT=A
 SENSEG NAME=OPERTON,PARENT=PARTMAST,PROCOPT=A
 SENSEG NAME=INVSTAT,PARENT=OPERTON,PROCOPT=A
 SENSEG NAME=OPERSGMT,PARENT=OPERTON
 PSBGEN LANG=COBOL,PSBNAME=APPLPGM4
 END
/*
```

Example 5

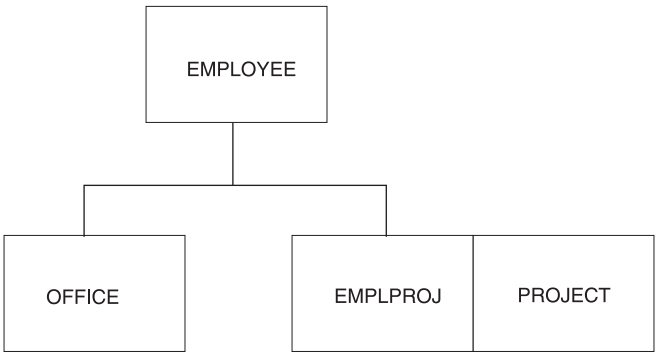
This example shows that a PSB generation is being performed for a batch program. A label (PARTROOT) is being used to indicate the only root segment in the PCB. The PCB's address will be excluded from the PCB list that is passed to the application at entry.

```
//PSBGEN   JOB  MSGLEVEL=1
//        EXEC    PSBGEN,MBR=APPLPGM5
//C.SYSIN   DD   *

 PARTROOT PCB TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=A,LIST=NO
 SENSEG NAME=PARTMAST,PARENT=0,PROCOPT=A
 PSBGEN LANG=COBOL,PSBNAME=APPLPGM5
 END
/*
```

Field Level Sensitivity PSB Generation Example

Figure 35 on page 142 shows a PCB for a batch program using field level sensitivity. The illustration shows the hierarchic order of the segments. The employee segment is at the first level. The office and employee project segments are at the second level. Outside of the hierarchic structure, but on the second level, the segment project is connected to the employee project segment.

Examples




```
SEGMENT NAME      FIELD NAME      START LOCATION      LENGTH

  EMPLOYEE        EMPSSN                1                9
                  EMPLNAME             10               10
                  EMPFNAME             20                9
                  EMPMI                29                1
                  EMPADDR              30               30

OFFICE            OFNUMBER              1                5
                  OFPHONE               6                7
EMPLPROJ          EPFUNCTN              1               20
                  EPTIMEST             21                5
                  EPTIMCUR             26                5

PROJECT           PROJNUM               1                8
                  PROJTTLE              9               20
                  PROJSTRT             29                8
                  PROJEND              37                8
                  PROJSTAT             45                1
```

```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

        PCB      TYPE=DB,NAME=FISDBD1,PROCOPT=GRP,KEYLEN=20
        SENSEG   NAME=EMPLOYEE,PARENT=0
        SENFLD   NAME=EMPLNAME,START=13,REPL=NO
        SENFLD   NAME=EMPFNAME,START=1,REPL=NO
        SENFLD   NAME=EMPMI,START=11
        SENSEG   NAME=OFFICE,PARENT=EMPLOYEE
        SENSEG   NAME=EMPLPROJ,PARENT=EMPLOYEE
        SENFLD   NAME=PROJNUM,START=1
        SENFLD   NAME=PROJTITLE,START=10
        SENFLD   NAME=EPFUNCTN,START=35
        SENFLD   NAME=EPTIMEST,START=60
        SENFLD   NAME=EPTIMCUR,START =70
        PSBGEN   LANG=ASSEM,PSBNAME=FISPCB1
        END
 /*
```

Figure 35. Sample Field Level Sensitivity PSB Generation

Fast Path PSB Generation Examples

The following two examples show sample Fast Path PSB Generations.

Example 1

This example shows the statements for an MSDB PSB containing eight PCBs.

```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB    TYPE=DB,DBDNAME=MSDBLM01,PROCOPT=R,     NONTERMINAL-RELATED     X
       KEYLEN=4                                END OF PCB STATEMENT
SENSEG NAME=LDM,PARENT=0                       (DEFAULT)
PCB    TYPE=DB,DBDNAME=MSDBLM02,PROCOPT=R,     NONTERMINAL-RELATED     X
       KEYLEN=1
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM03,PROCOPT=R,     NONTERMINAL-RELATED     X
       KEYLEN=2
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM04,PROCOPT=R,     NONTERMINAL-RELATED     X
       KEYLEN=8                                TERM KEYS
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM05,PROCOPT=R,     FIXED RELATED           X
       KEYLEN=8
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM06,PROCOPT=A,     DYNAMIC RELATED         X
       KEYLEN=8
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM06,PROCOPT=R,     DYNAMIC RELATED         X
       KEYLEN=8
SENSEG NAME=LDM,PARENT=0
PCB    TYPE=DB,DBDNAME=MSDBLM06,PROCOPT=G,     DYNAMIC RELATED         X
       KEYLEN=8
SENSEG NAME=LDM,PARENT=0
PSBGEN LANG=ASSEM,PSBNAME=DDLTM01              END OF PSBGEN MACRO
END    END OF PSB GEN
 /*
```

Example 2

This example shows the statements for DEDB subset pointers.

```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB    TYPE=DB,DBDNAME=MSDBLM01,PROCOPT=R,     NONTERMINAL-RELATED     X
PCB TYPE=DB,DBDNAME=X,PROCOPT=A,KEYLEN=100
SENSEG NAME=A,PARENT=C
SENSEG NAME=B,PARENT=A,SSPTR=((1,R),(2,U),(5))
SENSEG NAME=C,PARENT=B
SENSEG NAME=D,PARENT=A,SSPTR=((2,R))
PSBGEN LANG=COBOL,PSBNAME=APPI01
END
 /*
```

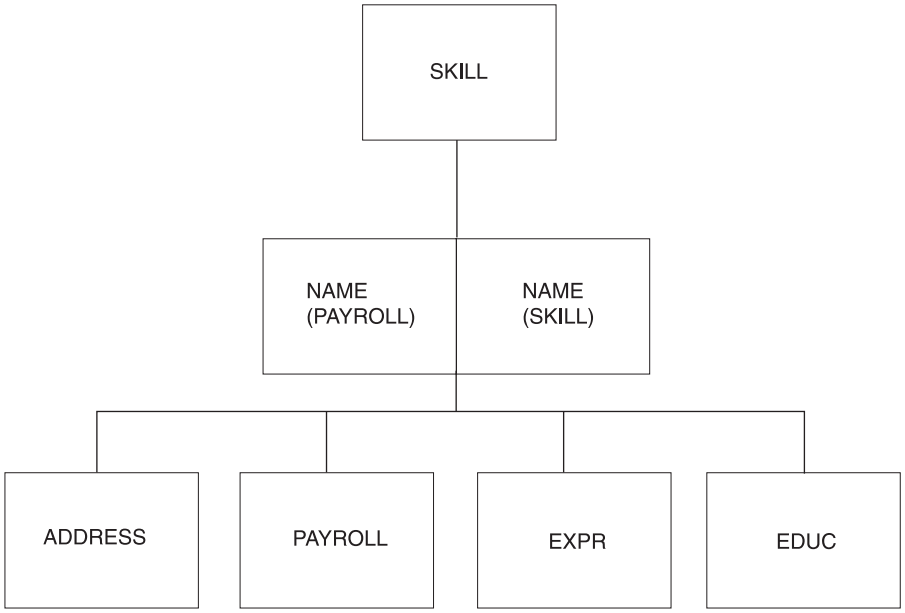
Notes:

1. SSPTR=((n,r))
   - **n** Subset pointer number in this SENSEG
   - **r** Sensitivity for the pointer (R: read, U: update)
2. If n and r are not specified, the pointer has no sensitivity.
3. If n is specified but r is not specified, the default is R (read sensitive).

Additional PSB Generation Examples

Example 1: The example in Figure 36 on page 144 shows a PSB generation that is being performed for a batch program. The illustration shows the hierarchic order of the segments. The Skill segment is at the first level. The Name segment (which is

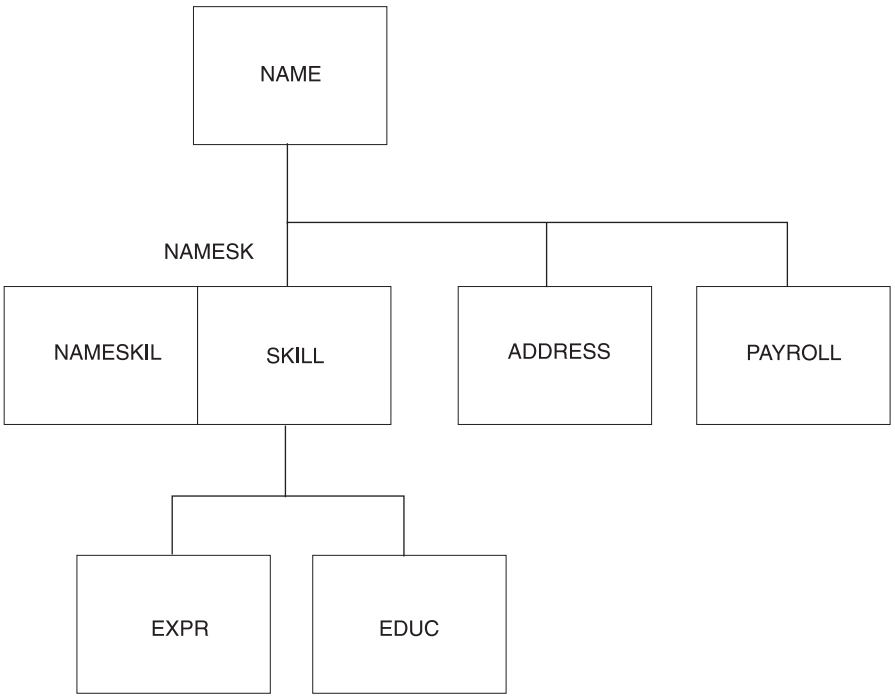
divided into payroll and skill) is at the second level. Address, Payroll, Expr, and Educ are on the third level.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=LOGIC1;PROCOPT=G,KEYLEN=151,POS=M
SENSEG      NAME=SKILL,PARENT=0,PROCOPT=A
SENSEG      NAME=NAME,PARENT=SKILL,PROCOPT=A
SENSEG      NAME=ADDRESS,PARENT=NAME,PROCOPT=A
SENSEG      NAME=PAYROLL,PARENT=NAME,PROCOPT=A
SENSEG      NAME=EXPR,PARENT=NAME,PROCOPT=A
SENSEG      NAME=EDUC,PARENT=NAME,PROCOPT=A
PSBGEN      LANG=COBOL,PSBNAME=PGMX
END
 /*
```

Figure 36. A PSBGEN Statement Used to Define a DL/I Database Statement (Example 1)

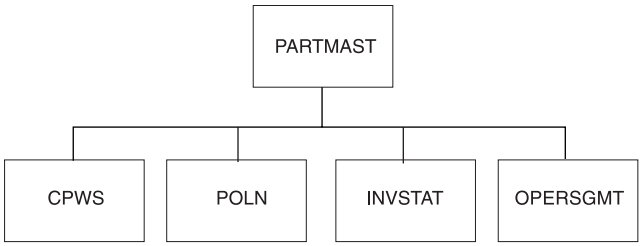
Example 2: The example in Figure 37 on page 145 shows a PSB generation that is being performed for a batch program. The illustration shows the hierarchic order of the segments. The NAME segment is at the first level. The NAMESK, ADDRESS, and PAYROLL segments are at the second level. The Expr and Educ segments are on the third level, connected to the NAMESK segment. Although the illustration separates the NAMESK segment into NAMESKIL and SKILL, the SENSEG statements do not define these as separate segments.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=LOGICDB,PROCOPT=A,KEYLEN=241,POS=M
SENSEG      NAME=NAME,PARENT=0,PROCOPT=G
SENSEG      NAME=NAMESK,PARENT=NAME,PROCOPT=G
SENSEG      NAME=EXPR,PARENT=NAMESK,PROCOPT=G
SENSEG      NAME=EDUC,PARENT=NAMESK,PROCOPT=G
SENSEG      NAME=ADDRESS,PARENT=NAME,PROCOPT=G
SENSEG      NAME=PAYROLL,PARENT=NAME,PROCOPT=G
PSBGEN      LANG=PL/I,PSBNAME=PGMY
END
 /*
```

Figure 37. A PSBGEN PCB Statement Used to Define a DL/I Database PCB Statement (Example 2)

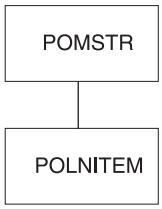
Example 3: The example in Figure 38 on page 146 shows a PSB that defines a logical relationship between segments in a DL/I database. The illustration shows the hierarchic order of the segments PARTMAST (the parent segment), CPWS, POLN, INVSTAT, and OPERSGMT (which are all first-level child segments of PARTMAST). The alternate statement sends output to logical terminal ″OUTPUT″. The PSBGEN statement saves this JCL as APPLPGM1 in the IMS.PSBLIB library.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=TP,LTERM=OUTPUT
PCB         TYPE=DB,DBDNAME=PARTMSTR,PROCOPT=GIDR,KEYLEN=100
SENSEG      NAME=PARTMAST,PARENT=0,PROCOPT=A
SENSEG      NAME=CPWS,PARENT=PARTMAST,PROCOPT=A
SENSEG      NAME=POLN,PARENT=PARTMAST,PROCOPT=A
SENSEG      NAME=INVSTAT,PARENT=PARTMAST,PROCOPT=A
SENSEG      NAME=OPERSGMT,PARENT=PARTMAST
PSBGEN      LANG=COBOL,PSBNAME=APPLPGM1
END
 /*
```

Figure 38. A PSBGEN PCB Statement Used to Define a DL/I Database PCB Statement (Example 3)

Example 4: The example in Figure 39 shows the JCL used to define the relationship between the POMSTR and POLNITEM segments from the DL/I database PODB. The alternate statements send output to applications with the transaction-code name ″out1″ and ″out2″.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=TP,NAME=OUT1
PCB         TYPE=TP,NAME=OUT2
PCB         TYPE=DB,DBDNAME=PODB,PROCOPT=GID,KEYLEN=200
SENSEG      NAME=POMSTR
SENSEG      NAME=POLNITEM,PARENT=POMSTR
PSBGEN      LANG=COBOL,PSBNAME=APPLPGM3
END
 /*
```

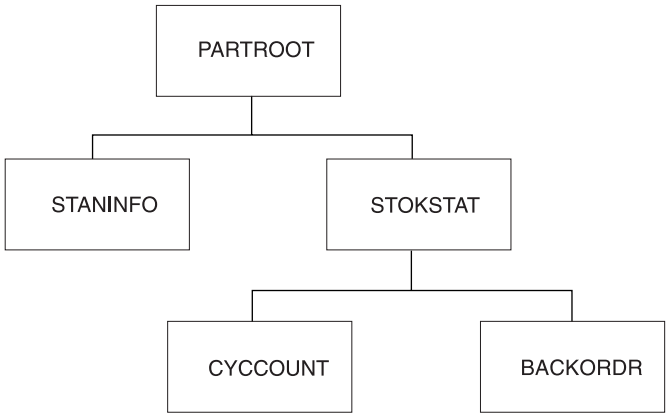
Figure 39. A PSBGEN PCB Statement Used to Define a Logical Relationship and Produce Output

Examples of a Sample Problem with an Application Database

Examples five through ten use DBDNAME=DI21PART as a basis for the logical databases created with each example's JCL. The database contains segments PARTROOT, STANINFO, STOKSTAT, CYCCOUNT, and BACKORDR. PARTROOT

is the parent segment. STANINFO and STOKSTAT are child segments of PARTROOT. CYCCOUNT and BACKORDR are child segments of STOKSTAT.

Example 5: The example in Figure 40 shows either a message switching or conversational message program. The JCL is saved as load module DFSSAM01 in the IMS.PSBLIB library.

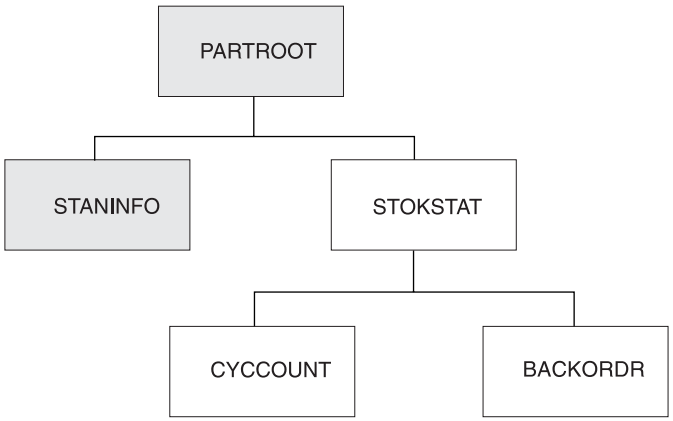



```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

SENSEG      NAME=BACKORDR,PARENT=STOKSTAT
PSBGEN      LANG=COBOL,PSBNAME=DFSSAM01
END
 /*
```

Figure 40. The Data Structure and JCL For a Message Switching or Conversational Message Program

Example 6: The JCL shown in Figure 41 on page 148 defines a logical relationship between the PARTROOT and STANINFO segments (shown in the illustration with shading). The JCL is saved as load module DFSSAM02 in the IMS.PSBLIB library.

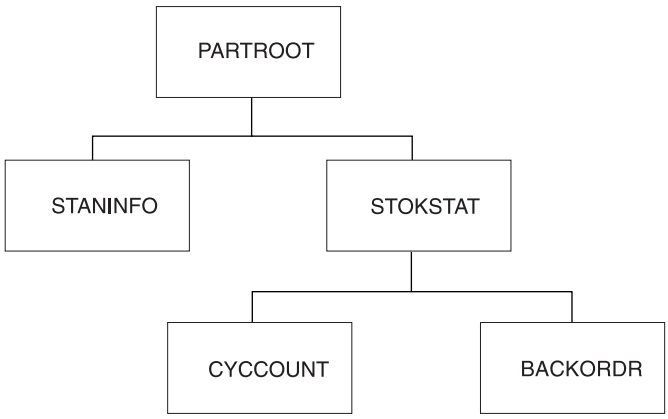
Examples




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB          TYPE=DB,DBDNAME=DI21PART,PROCOPT=G,KEYLEN=19
SENSEG       NAME=PARTROOT
SENSEG       NAME=STANINFO,PARENT=PARTROOT
PSBGEN       LANG=COBOL,PSBNAME=DFSSAM02
END
 /*
```

Figure 41. The Data Structure and JCL For a Logical Relationship in Database DI21PART

Example 7: The example in Figure 42 on page 149 defines the entire logical structure from the DL/I database DI21PART. The JCL is saved as load module DFSSAM03 in the IMS.PSBLIB library.

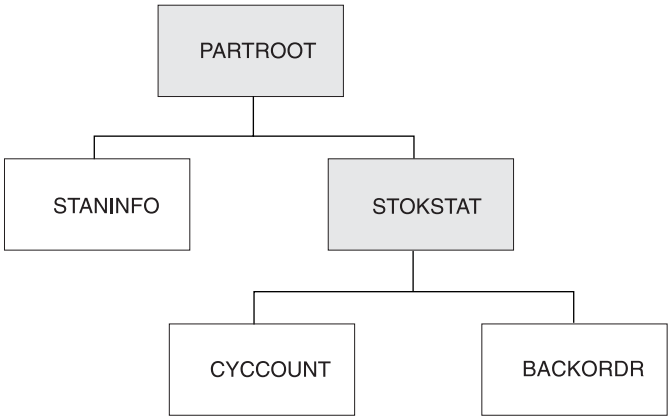



```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=DI21PART,PROCOPT=G,KEYLEN=43
SENSEG      NAME=PARTROOT
SENSEG      NAME=STANINFO,PARENT=PARTROOT
SENSEG      NAME=STOKSTAT,PARENT=PARTROOT
SENSEG      NAME=CYCCOUNT,PARENT=STOKSTAT
SENSEG      NAME=BACKORDR,PARENT=STOKSTAT
PSBGEN      LANG=COBOL,PSBNAME=DFSSAM03
END
 /*
```

Figure 42. The Data Structure and JCL For a Logical Database Defined From DL/I Database DI21PART

Example 8: The example in Figure 43 on page 150 defines the logical relationship between the PARTROOT and STOKSTAT segments (shown in the illustration with shading). The JCL also outputs to the logical terminal HOWARD and saves the JCL as load module DFSSAM03 in the IMS.PSBLIB library.

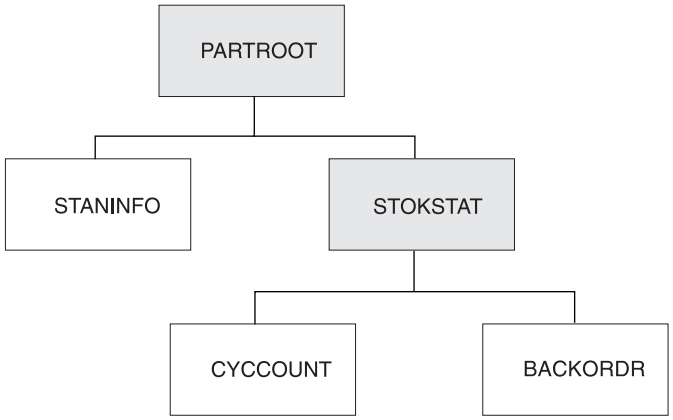
Examples




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=TP,LTERM=HOWARD
PCB         TYPE=DB,DBDNAME=DI21PART,PROCOPT=A,KEYLEN=33
SENSEG      NAME=PARTROOT
SENSEG      NAME=STOKSTAT,PARENT=PARTROOT
PSBGEN      LANG=COBOL,PSBNAME=DFSSAM05
END
 /*
```

Figure 43. The Data Structure and JCL For a Logical Relationship in Database DI21PART That Produces Output (Part 1)

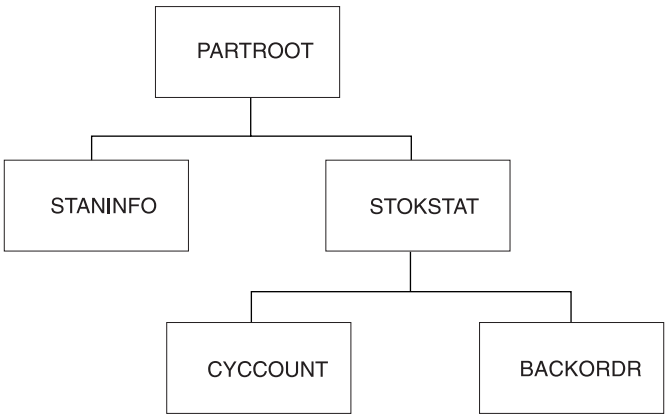
Example 9: The example in Figure 44 on page 151 is identical to example 8, except this JCL is saved as load module DFSSAM06 in the IMS>PSBLIB library.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=TP,LTERM=HOWARD
PCB         TYPE=DB,DBDNAME=DI21PART,PROCOPT=A,KEYLEN=33
SENSEG      NAME=PARTROOT
SENSEG      NAME=STOKSTAT,PARENT=PARTROOT
PSBGEN      LANG=COBOL,PSBNAME=DFSSAM06
END
 /*
```

Figure 44. The Data Structure and JCL for a Logical Relationship in Database DI21PART That Produces Output (Part 2)

Example 10: The example in Figure 45 on page 152 defines the entire logical structure from the DL/I database DI21PART. The JCL is saved as load module DFSSAM07 in the IMS.PSBLIB library.




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=DI21PART,PROCOPT=G,KEYLEN=43
SENSEG      NAME=PARTROOT
SENSEG      NAME=STANINFO,PARENT=PARTROOT
SENSEG      NAME=STOKSTAT,PARENT=PARTROOT
SENSEG      NAME=CYCCOUNT,PARENT=STOKSTAT
SENSEG      NAME=BACKORDR,PARENT=STOKSTAT
PSBGEN      LANG=COBOL,PSBNAME=DFSSAM07
END
 /*
```

Figure 45. The Data Structure and JCL for a Logical Database Defined From DL/I Database DI21PART

Example of a Shared Secondary Index

Example 11: The database structure for this example is shown in Figure 46 on page 153. It shows a database, DTA3, that is indexed by three secondary indexes (X4, X5, and X6) in a shared secondary index database, X4. Each secondary index uses a different segment as both its index target segment and index source segment. Secondary index X4 uses DTA3 segment DA as its target/source segment. Secondary index X5 uses DTA3 segment DC as its target/source segment. Secondary index X6 uses DTA3 segment DE as its target/source segment.

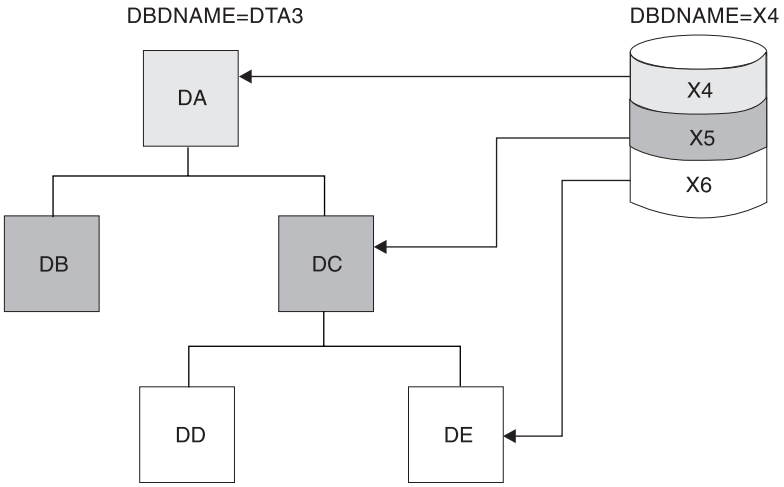
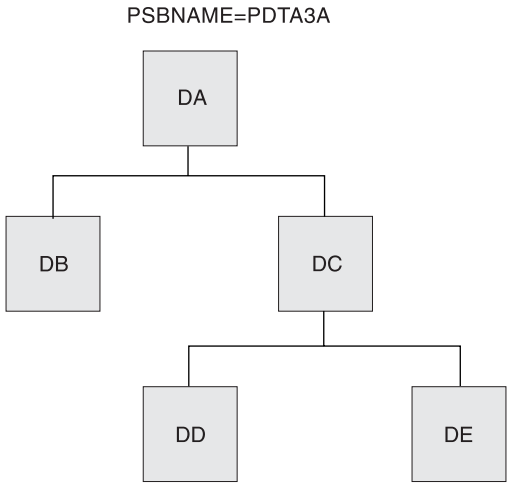


Figure 46. Database Indexed by Three Secondary Indexes in a Shared Secondary Index Database

The database structure for index through DA is shown in Figure 47. It contains segments DA, DB, DC, DD, and DE.

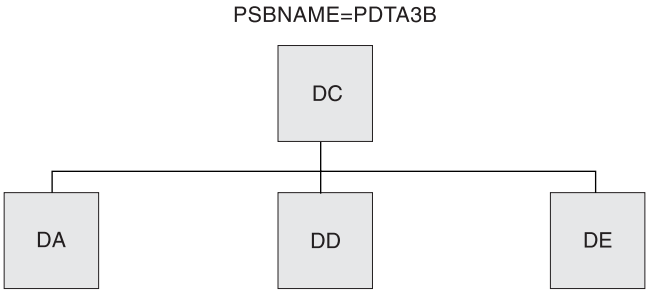



```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=DTA3,PROCOPT=A,KEYLEN=15,PROCSEQ=X4
SENSEG      NAME=DA,PARENT=0
SENSEG      NAME=DB,PARENT=DA
SENSEG      NAME=DC,PARENT=DA,INDICES=X5
SENSEG      NAME=DD,PARENT=DC
SENSEG      NAME=DE,PARENT=DC,INDICES=X6
PSBGEN      LANG=COBOL,PSBNAME=PDTA3A
END
 /*
```

Figure 47. The Data Structure and JCL For Index Through Segment DA

The database structure for index through DC is shown in Figure 48 on page 154. It shows segment DC, DA, DD, and DE.

Examples



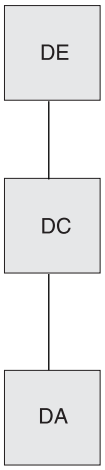

```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=DTA3,PROCOPT=A,KEYLEN=15,PROCSEQ=X5
SENSEG      NAME=DC,PARENT=0
SENSEG      NAME=DA,PARENT=DC,INDICES=X4
SENSEG      NAME=DD,PARENT=DC
SENSEG      NAME=DE,PARENT=DC,INDICES=X6
PSBGEN      LANG=COBOL,PSBNAME=PDTA3B
END
 /*
```

Figure 48. The Data Structure and JCL For Index Through Segment DC

This database structure can also include, as a substructure, the database structure for index through DA.

The database structure for index through DE is shown in Figure 49 on page 155. It shows segments DE, DC, and DA.

PSBNAME=PDTA3B




```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=DTA3,PROCOPT=A,KEYLEN=15,PROCSEQ=X6
SENSEG      NAME=DE,PARENT=0
SENSEG      NAME=DC,PARENT=DE,INDICES=X5
SENSEG      NAME=DA,PARENT=DC,INDICES=X4
PSBGEN      LANG=COBOL,PSBNAME=PDTA3C
END
 /*
```

Figure 49. The Data Structure and JCL For Index Through Segment DE

This database structure can also include, as substructures, the database structures for indexes through DA and DC.

The PCB for INDEX database is shown as follows:

```
 //PSBGEN   JOB  MSGLEVEL=1
 //        EXEC    PSBGEN,MBR=APPLPGM1
 //C.SYSIN   DD   *

PCB         TYPE=DB,DBDNAME=X4,PROCOPT=A,KEYLEN=5
SENSEG      NAME=X4A,PARENT=0
PCB         TYPE=DB,DBDNAME=X5,PROCOPT=A,KEYLEN=5
SENSEG      NAME=X5A,PARENT=0
PCB         TYPE=DB,DBDNAME=X6,PROCOPT=A,KEYLEN=5
SENSEG      NAME=X6A,PARENT=0
PSBGEN      LANG=COBOL,PSBNAME=PX4
END
 /*
```

Examples

Chapter 3. Application Control Blocks Maintenance Utility

When an application program is scheduled for execution, IMS must first have available database descriptor (DBD) and PSB control blocks previously created by the DBDGEN and PSBGEN procedures.

Related Reading: For a description of the DBGEN procedure, see *IMS Version 9: Utilities Reference: Database and Transaction Manager*.

These control blocks must then be merged and expanded into an IMS internal format called *application control blocks* (ACBs). The merge and expansion process is called *block building.*

The Application Control Blocks Maintenance utility saves instruction execution and direct-access wait time and improves performance in application scheduling. It provides a facility for pre-building the required application control blocks off-line; hence, when the application is scheduled, its application control blocks can be read in directly, and control can be passed promptly to the application program.

Application control blocks required for the DB/DC environment must be prebuilt, except for application programs that use a GPSB. It is optional for the batch environment. Using IMS.ACBLIB in a batch environment requires less virtual storage than building the ACBs dynamically from PSBLIB and DBDLIB.

The Application Control Blocks Maintenance utility maintains the prebuilt blocks (ACB) library (IMS.ACBLIB). The ACB library is a consolidated library of program (PSB) and database (DBD) descriptions. Through control statements, you can direct the maintenance utility to build all control blocks for all PSBs, for a specific PSB, or for all PSBs that reference a specific DBD. This utility does **not** change the PSB in IMS.PSBLIB or the DBD in IMS.DBDLIB. If changes are made in either PSBs or DBDs that require changes in the associated PSB or DBD, you must make these changes before running the utility. You can make additions, changes, and deletions to IMS.ACBLIB without stopping IMS, by using the Online Change utility and commands.

Related Reading: See Chapter 7, “Online Change Utilities and Procedures,” on page 231 for more information on using the Online Change utility.

Changes in PSBs might also require modifications to the affected application programs. For example, if a DBD has a segment name changed, all PSBs which are sensitive to that segment must have their SENSEG statements changed.

Application programs which use this database might also need to be modified.

The following topics provide additional information:

Restrictions for ACB Generation

You do not need to run ACB generation if your application program requires only an I/O PCB and one modifiable alternate PCB. Such applications, typically used in a DCCTL environment, can use GPSBs to define the resources necessary for execution.

You cannot predefine GSAM PSBs and DBDs using ACB generation because the control blocks for GSAM are different from the standard IMS data set control blocks. PSBs that reference GSAM, as well as non-GSAM databases, can be predefined using ACB generation to build the control block for the non-GSAM databases.

IMS conforms to z/OS rules for data set authorization. If an IMS job step is authorized, all libraries used in that job step must be authorized. To run an IMS batch region as unauthorized, a non-authorized library must be concatenated to IMS.SDFSRESL.

The Application Control Blocks Maintenance utility uses some IMS system resources but not the total system. IMS.PSBLIB and IMS.DBDLIB are shared data sets. IMS.ACBLIB must be used exclusively. The utility can only be executed using an ACB library which is not concurrently allocated to an active IMS system.

IMS.ACBLIB is modified and cannot be used for any other purpose during execution of this program. IMS.ACBLIB is a partitioned data set and carries required linkage information in the directory. You can use the operating system (IEHMOVE) and data set (IEBCOPY) utilities for maintenance purposes.

Do not add FP DBDs to the active ACBLIB between an abnormal termination and /ERE. FP DBDs added to the active ACBLIB after abnormal termination of IMS are inaccessible after /ERE.

When specifying BUILD PSB=ALL on a SYSIN control statement, all PSBs must reside in a single PSBLIB. No concatenated PSBLIBs will be acknowledged on the IMS DD statement.

Input and Output for ACB Generation

Figure 50 on page 159 shows the functional relationship of the I/O data sets and their naming requirements. The Application Control Block Maintenance utility receives input from IMSVS.DBDLIB data set, IMS.PSBLIB data set, SYSIN control statements, COMPCTL IEBCOPY control statements, and SYSPRINT messages. The ACB Maintenance utility outputs to the SYSUT3 and SYSUT4 IEBCOPY utility data sets, and the IMSVS.ACBLIB data set.

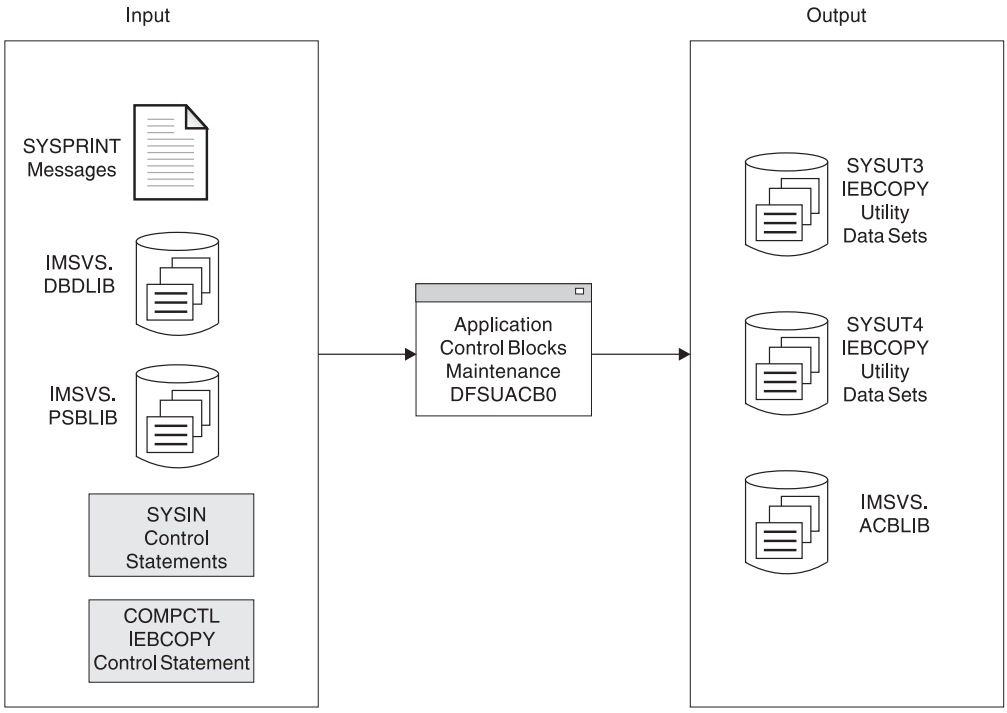


Figure 50. Application Control Blocks Maintenance Utility

ACB Generation Procedure

The procedure shown in Figure 51 is created as a part of system definition. It is placed into the IMS.PROCLIB procedure library by stage two of IMS system definition.

Figure 51 shows the procedure for ACBLIB maintenance.

```
//       PROC SOUT=A,COMP=,RGN=4M,SYS2=
//G      EXEC PGM=DFSRRC00,PARM='UPB,&COMP',
//       REGION=&RGN
//SYSPRINT DD SYSOUT=&SOUT
//STEPLIB  DD DSN=IMS.&SYS2.SDFSRESL,DISP=SHR
//DFSRESLB DD DSN=IMS.&SYS2.SDFSRESL,DISP=SHR
//IMS      DD DSN=IMS.&SYS2.PSBLIB,DISP=SHR
//         DD DSN=IMS.&SYS2.DBDLIB,DISP=SHR
//IMSACB   DD DSN=IMS.&SYS2.ACBLIB,DISP=OLD
//SYSUT3   DD UNIT=SYSDA,SPACE=(80,(100,100))
//SYSUT4   DD UNIT=SYSDA,SPACE=(256,(100,100)),
//            DCB=KEYLEN=8
//COMPCTL  DD DISP=SHR,
//         DSN=IMS.&SYS2.PROCLIB(DFSACBCP)
```

Figure 51. ACBLIB Maintenance Procedure

In Figure 51, the high level qualifier of the IMS data sets is IMS. This is the default provided by IMS generation. However, if the default value was not used in IMS generation at your installation, the high level qualifier for the IMS data set names might not be IMS.

Invoking the Procedure

The following is a sample of the JCL statements that can be used to invoke the ACB generation procedure.

```
//ACBGEN   JOB  MSGLEVEL=1
//         EXEC ACBGEN
//SYSIN    DD   *
 BUILD PSB=(MYPSB)
```

The ACB generation procedure uses the following symbolic variables:

SOUT=
Specifies the SYSOUT class. The default is A.

COMP=
PRECOMP,POSTCOMP, in any combination, cause the required in-place compression. The default is none.

RGN=
Specifies the region size for execution of the ACB utility. This depends on the size of the blocks to be generated and typically varies from 100 to 150KB. The default is 256KB.

SYS2=
Specifies an optional second-level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must include a trailing period and be enclosed in quotes, for example:

```
SYS2='IMSA.'
```

EXEC Statement

The first part of the EXEC statement must be in the form:

```
PGM=DFSRRC00
```

A parameter field must be in the form:

```
PARM='UPB,PRECOMP,POSTCOMP'
```

where PRECOMP requests the IMS.ACBLIB data set be compressed before blocks are built, and POSTCOMP requests compression after the blocks are built. 'UPB' indicates that the block maintenance utility is to receive control. This parameter is required. PRECOMP and POSTCOMP are optional and can be used in any combination.

DD Statements

STEPLIB DD
Points to IMS.SDFSRESL, which contains the IMS nucleus and required action modules. If STEPLIB is unauthorized by having unauthorized libraries concatenated to IMS.SDFSRESL, you must include a DFSRESLB DD statement.

DFSRESLB DD
Points to an authorized library which contains the IMS SVC modules. For IMS batch, SDFSRESL and any data set that is concatenated to it on the DFSRESLB DD statement must be authorized through the Authorized Program Facility (APF). This DD statement provides an authorized library for the IMS SVC modules, which must reside in an authorized library. The JOBLIB or STEPLIB statement need not be authorized for IMS batch.

SYSPRINT DD
Defines the output message data set.

IMS DD
Defines the IMS.PSBLIB and IMS.DBDLIB data sets.

IMSACB DD
Defines the IMS.ACBLIB data set.

Restriction: This data set is modified and cannot be shared with other jobs.

SYSUT3 DD
Defines a work data set that is required if either PRECOMP or POSTCOMP is specified on the EXEC statement.

Related Reading: Refer to the *z/OS DFSMSdfp™ Utilities* manual for more information about space allocation requirements.

SYSUT4 DD
Same function as SYSUT3.

COMPCTL DD
Defines the control input data set to be used by IEBCOPY if PRECOMP or POSTCOMP is specified.

If both PRECOMP and POSTCOMP are requested on the EXEC statement parameters, this data set must be capable of being closed with a reread option.

Recommendation: It is suggested that this data set reference a member of IMS.PROCLIB containing the following required control statement:

```
//COMPCTL  DD DISP=SHR,
//         DSN=IMS.&SYS2.PROCLIB(DFSACBCP)
```

SYSIN DD
Defines the input control statement data sets. They can reside on a tape volume, direct-access device, card reader, or be routed through the input stream. The input can be blocked as multiples of 80. During execution, this utility can process as many control statements as required.

DFSACBCP Control Statement

The following control statement is created as a part of system definition and is placed in the IMS.PROCLIB procedure library by stage two of IMS system definition.

The ACB generation procedure uses DFSACBCP to compress ACBLIB.

```
COPY  INDD=IMSACB,OUTDD=IMSACB
```

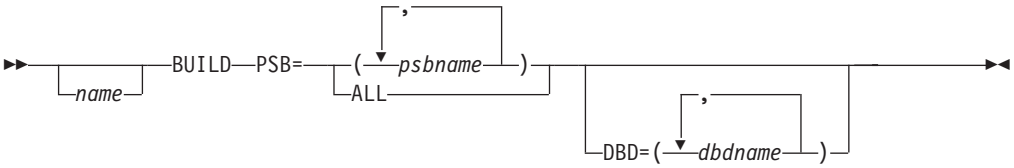
Utility Control Statements for ACB Generation

The following guidelines apply to the utility control statements for ACBGEN:

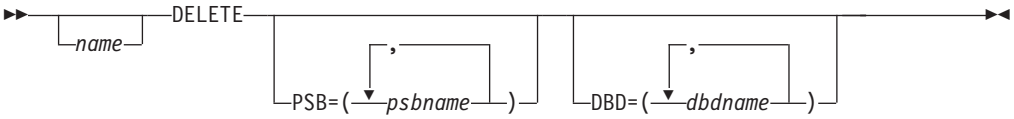
- The utility control statements for this program are coded with one restriction: To continue a statement, enter a non-blank character in column 72 and begin the statement on the next line starting in column 16.
- A statement is coded as a card image and is contained in columns 1 to 71.
- The control statement can optionally contain a name, starting in column 1.
- The operation field must be preceded and followed by one or more blanks.
- The parameter is composed of one or more PSB/DBD names and must also be preceded and followed by one or more blanks.

- Commas, parentheses, and blanks can be used only as delimiting characters.
- Comments can be written following the last parameter of a control statement, separated from the parameter by one or more blanks.

ACB Maintenance Utility Syntax: Build format



ACB Maintenance Utility Syntax: Delete Format



BUILD
Indicates that blocks are to be built for the named PSBs which refer to the named DBDs.

DELETE
Indicates that blocks are to be deleted from ACBLIB. The named PSBs and all PSBs that refer to the named DBDs are deleted.

PSB=ALL
Means blocks are to be built for all PSBs that currently reside in IMS.PSBLIB. When this function is specified, all PSBs and DBDs (and any other modules) are deleted from the ACBLIB data set and their space is made available for reuse. Then an ACB generation is executed for every PSB in PSBLIB. Do not use this parameter with a DELETE statement. You use this parameter to create an initial IMS.ACBLIB.

Requirement: When you specify BUILD PSB=ALL on a SYSIN control statement, all PSBs must reside in a single PSBLIB. No concatenated PSBLIBs will be acknowledged on the IMS DD statement.

PSB=(psbname)
Means blocks are to be built or deleted for all PSBs named on this control statement. As many of this type of control statement as required can be submitted. This parameter is normally used to add a new PSB to IMS.ACBLIB or delete a PSB no longer in use. You can omit the parentheses if you supply a single parameter.

DBD=(dbdname)
Means blocks are to be built or deleted for this DBD and for all PSBs which reference this DBD either directly or indirectly through logical relationships. The DBD to be built must already exist in IMS.ACBLIB. The referencing PSBs must already exist in IMS.ACBLIB. PSBs newly added to IMS.PSBLIB must be referenced by PSB= operands. Because deleting a PSB does not delete any DBDs referenced by the PSB, this parameter can be used to delete specific DBDs. However, deleting or building a DBD causes every PSB in IMS.ACBLIB that references the named DBD to be rebuilt or deleted based on the request type. You can omit the parentheses if you supply a single parameter.

Example: PSB-a references DBD-a and DBD-b. A DBDGEN was done for DBD-a and DBD-b and the updated DBDs are in DBDLIB (but not ACBLIB yet). By specifying DBD-a in an ACB generation, DBD-a is rebuilt in ACBLIB and any referencing PSBs (in this case PSB-a) are also rebuilt. Even though PSB-a has been rebuilt, the ACBLIB is not usable because DBD-b was not specifically rebuilt in ACBLIB. For DBD-b to be rebuilt in ACBLIB, it must be explicitly specified in the ACB generation. In summary, even though the referencing PSB is completely updated, but the updated DBDs must be explicitly specified in the ACB generation.

Every PSB processed by this program generates a member in the IMS.ACBLIB data set. DBDs referenced by PSBs generate a member the first time the specific DBD is processed or any time a DBD name appears on a control statement. All PSBs that reference the same DBD carry information in their directory entries to connect the PSB to the referenced DBDs.

Logical DBDs do not generate a member in IMS.ACBLIB and cannot be referenced on BUILD or DELETE control statements.

When a DBD is replaced in IMS.DBDLIB, it must also be included in a BUILD DBD control statement. This is the **only** valid way the DBD can be replaced in IMS.ACBLIB without doing a BUILD PSB=ALL.

If a BUILD PSB is performed that references a modified DBD on DBDLIB, the PSB replaced on ACBLIB will contain the updated version of the DBD. If this BUILD PSB occurs before a BUILD DBD for the changed DBD, ACBLIB will contain PSBs with different versions of the DBD. The PSBs specified in the BUILD PSB will contain the updated DBD, while those not built will reference the old DBD. When a DBD for a PSB on ACBLIB does not match the accessed database, the results will be unpredictable. (For example, U852 abend occurs because segment codes have been added or deleted in the changed DBD). Therefore, when DBDGEN is run for later use, do not build a PSB that refers to the changed DBD unless the database reflects the change.

When a physical DBD is changed and is referenced in a BUILD DBD statement, all physical DBDs that are logically related to the one that was changed (including primary indexes and secondary indexes) must also be referenced in a BUILD DBD statement. However, DBDs that are logically related to these DBDs do not need to be rebuilt.

Figure 52 on page 164 illustrates the relationships between some physical databases, where A is the changed DBD. The following relationships exist:

- B and C are logically related to A.
- D is logically related to B.
- E is logically related to C.
- D and E are not referenced in the BUILD DBD statement because they are not logically related to A.

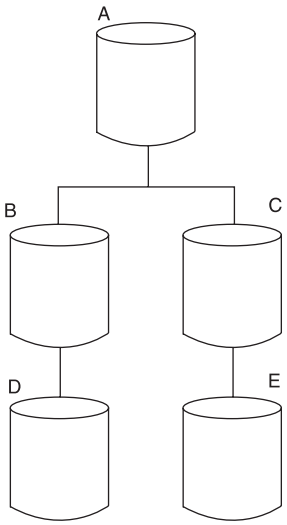


Figure 52. Example of Logically Related Physical Databases

Managing Dynamic Option (DOPT) PSBs

Using dynamic option (DOPT) PSBs requires concatenation of the following ACBLIB data sets:

- A primary ACBLIB data set to contain blocks for all non-dynamic PSBs
- A DOPT ACBLIB data set to contain blocks for all dynamic option PSBs

The primary ACBLIB data sets is the first DD statement of the concatenation. To BUILD a PSB or DBD into the concatenated data sets, supply only one DD statement to the ACB Maintenance utility.

At system initialization time, all non-dynamic PSBs and all DBDs must have been built into either the primary or DOPT ACBLIB data sets.

By transaction schedule time, the DOPT PSBs being scheduled must be built into the DOPT ACBLIB data sets. Never build DOPT PSBs into the primary ACBLIB data sets.

If all PSBs in the system are DOPT PSBs, the primary ACBLIB should be a dummy PDS data set. The DOPT ACBLIB should contain blocks for all DBDs and PSBs. Set the DIRCA size parameter in the BMP, MPP, or IFP JCL.

If some, but not all, PSBs in the system are DOPT PSBs, both ACBLIB data sets will contain blocks for DBDs and PSBs. Remember, when you BUILD a PSB into one ACBLIB data set, the blocks for the DBDs referenced by the PSB are also built into that data set. If the DBD was already built into another ACBLIB data set, you will have two sets of blocks for the DBD. When DL/I does a BLDL to use the blocks for the DBD, it uses the set of blocks in the primary ACBLIB.

During the termination process of a program using DOPT PSBs, the PSBs are deleted from the PSB pool.

Related Reading: Refer to the section on the APPLCTN Macro in *IMS Version 9: Installation Volume 2: System Definition and Tailoring* for further information about using DOPT.

Error Processing for ACB Generation

The ACB generation procedure returns the following codes:

Code	Meaning
0	Successful completion of all operations
4	One or more warning messages issued
8	One or more blocks could not be built
16	Program terminated due to severe errors

Examples of ACB Generation

This section includes examples of the use of the Application Control Blocks Maintenance utility.

Example of Creating Blocks for All PSBs

In this example, all blocks currently existing in IMS.ACBLIB are deleted and their space is reused to create new blocks for all PSBs that currently reside in IMS.PSBLIB. This option will normally be used for initial creation of the IMS.ACBLIB data set. If space is not yet allocated for ACBLIB, there should be a space parameter and a DISP=NEW on the IMSACB DD statement.

```
//BLDBLKS  JOB 1,1,MSGLEVEL=(1,1)
//*
//STEP    EXEC ACBGEN,SOUT=A
//SYSIN     DD *
            BUILD PSB=ALL
/*
```

Example of Creating Blocks for Specific PSBs

This example creates blocks for PSB1, PSB2, and PSB3. All other PSBs in IMS.ACBLIB remain unchanged. If any DBDs referenced by these PSBs do not exist in IMS.ACBLIB, they are added. In addition, DBD5 and DBD6 are deleted from ACBLIB. IMS.ACBLIB is compressed after the blocks are built, and deletions are performed.

```
//BLDBLKS  JOB 1,1,MSGLEVEL=(1,1)
//*
//STEP    EXEC ACBGEN,SOUT=A,COMP=POSTCOMP
//SYSIN     DD *
            BUILD  PSB=(PSB1,PSB2,PSB3)
            DELETE DBD=(DBD5,DBD6)
/*
```

Example of Deleting a PSB and Rebuilding Blocks

This example deletes PSB1 from the IMS.ACBLIB data set and causes all PSBs in the IMS.ACBLIB data set that reference DBD4 to have their blocks rebuilt. If PSB1 referenced DBD4, it will not be rebuilt, since PSB1 had just been deleted from IMS.ACBLIB. PSB1 is **not** deleted from IMS.PSBLIB. The IMS.ACBLIB is compressed before and after the blocks have been built.

```
//BLDBLKS  JOB 1,1,MSGLEVEL=(1,1)
//*
//STEP    EXEC ACBGEN,SOUT=A,COMP='PRECOMP,POSTCOMP'
//SYSIN     DD *
     DELETE PSB=PSB1
     BUILD DBD=DBD4
  /*
```

Chapter 4. DLIModel Utility

In order for a Java application to access an IMS database, it needs information about the database. This information is contained in the PSB (program specification block) and DBDs (database descriptions), but you must first convert this information into a form that you can use in the Java application: a subclass of the `com.ibm.ims.db.DLIDatabaseView` class called the IMS Java metadata class. The DLIModel utility generates this metadata from the IMS PSBs, DBDs, COBOL copybooks, and other input specified by utility control statements.

In addition to creating metadata, the DLIModel utility also:

- Generates XML schemas of IMS databases. These schemas are used when retrieving XML data from or storing XML data in IMS databases.
- Incorporates additional field information from XMI input files that describe COBOL copybooks.
- Incorporates additional PCB, segment, and field information, or overrides existing information.
- Generates a DLIModel IMS Java Report, which is designed to assist Java application programmers. The DLIModel IMS Java Report is a text file that describes the IMS Java view of the PSB and its databases.
- Generates an XMI description of the PSB and its databases.

The DLIModel utility can process most types of PSBs and databases. For example, the utility supports:

- All database organizations except MSDB, HSAM, SHSAM, and GSAM
- All types and implementations of logical relationships
- Secondary indexes, except for shared secondary indexes
- Secondary indexes that are processed as stand-alone databases
- PSBs that specify field-level sensitivity

The DLIModel utility is a Java application, so you can run it from the UNIX® System Services prompt, or you can run it using the z/OS-provided BPXBATCH utility.

Figure 53 on page 168 shows the inputs to and outputs from the DLIModel utility.

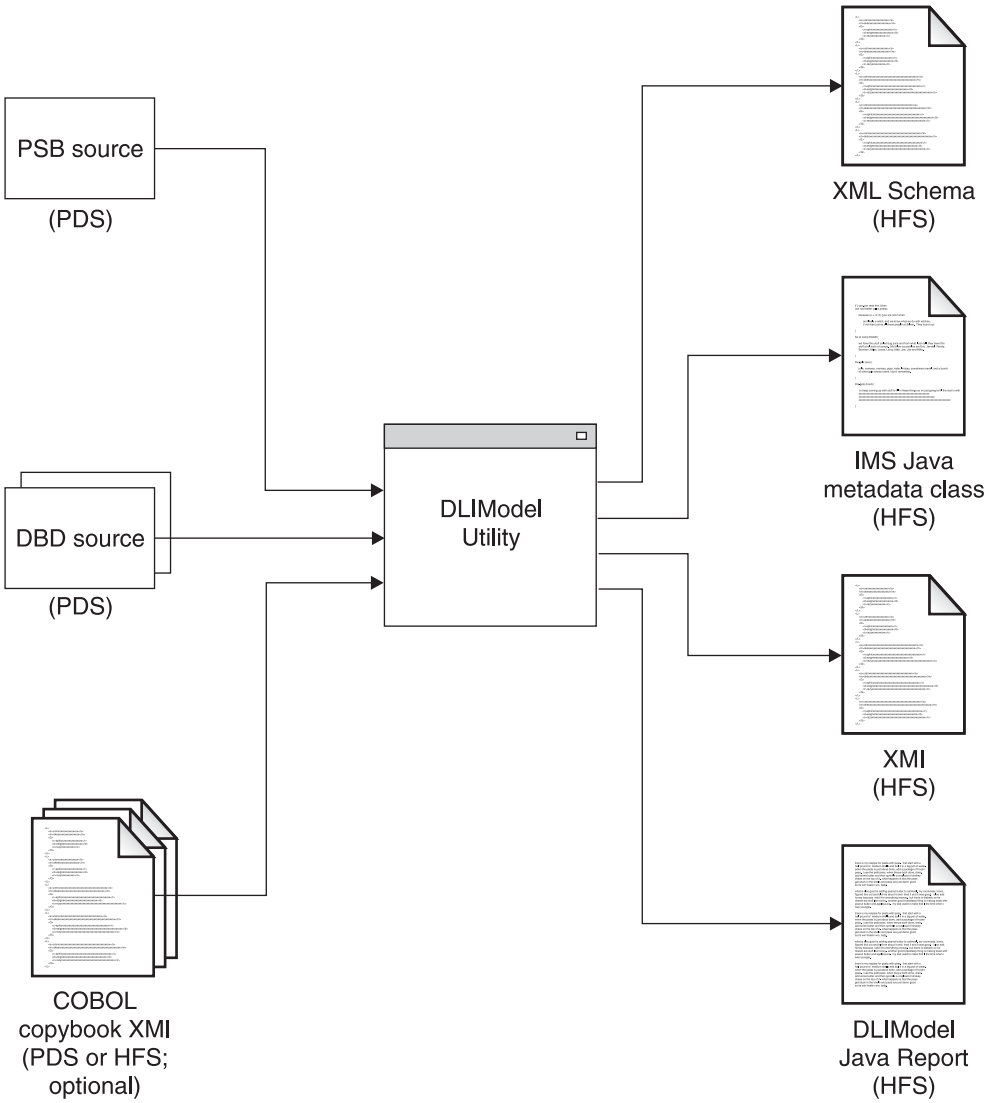


Figure 53. DLIModel Utility Inputs and Outputs

The actions of the DLIModel utility are directed by control statements that you supply. The control statements can specify:

- Which PSB to process during a run
- Aliases for the PSB, PCBs, segments, and fields
- Data types and format masks for fields
- XMI files that contain XMI descriptions of COBOL copybook members for segments
- Additional field definitions for fields that are not defined in the DBD or the COBOL copybook XMI file
- Information that overrides PSB, DBD, and COBOL copybook XMI information
- Default values for newly inserted segments

The DLIModel utility reads the PSB and DBD source members from the partition data set (PDS) or partition data set extended (PDSE) and parses them to build an in-memory model of the database structure and the PSB's view of that structure. The utility then generates the outputs that were requested through control statements.

You can specify an XMI description of the entire in-memory model in which one description covers the PSB and all DBDs processed in the run. For details about this XMI output, see “XMI Description of the Databases” on page 172.

You can also request a detailed trace file of the DLIModel utility execution if such a trace is necessary for problem resolution.

The following topics provide additional information:

- “PSB and DBD Requirements”
- “DLIModel Utility Restrictions” on page 170
- “Output Types of the DLIModel Utility” on page 170
- “Control Statements for the DLIModel Utility” on page 178
- “Running the DLIModel Utility” on page 174
- “Examples of Using the DLIModel Utility” on page 189

Related Reading: For more information on Java application programming with IMS, see *IMS Version 9: IMS Java Guide and Reference*.

PSB and DBD Requirements

This section describes the PSB and DBD requirements to run the DLIModel utility.

- The DLIModel utility does not validate the PSB and DBD source. IBM strongly recommends that you generate DBDs, PSBs, and ACBs, correct all errors, and then run the DLIModel utility.
- PCBs in the PSB must be named, either through statement labels or the PCBNAME parameter.
- If your application uses JDBC and the JDBC call includes fields from more than one segment in a hierarchical path, IMS Java uses path calls. In order for the application to be able to retrieve fields from multiple segments, you must include P as a processing option (PROCOPT) in the PCB or SENSEG statements, as appropriate.
- If your application uses the IMS Java hierarchical database interfaces (SSA database access), path calls are under your control, and you must choose the appropriate PSB processing options.
- The DLIModel utility follows all references in DBDs to other DBDs when building its model, and might require access to DBDs that are not directly referenced by PCBs in the PSB. For example, when processing a PSB that references a main database with a number of secondary indexes, the DLIModel utility needs access to the secondary index DBDs even if the PSB does not explicitly name any of these indexes. Similarly, all DBDs that are related by logical relationships must be accessible.
- You must maintain the length field in variable length segments for INSERT or UPDATE statements.

COBOL Copybook XMI Requirements

This section describes the requirements for the optional COBOL copybook XMI files.

- XMI input files must conform to the COBOL metamodel, which is part of the CAM metamodel of the OMG-accepted version of the UML specification for the Enterprise Application Integration (EAI) standard.

- COBOL copybook XMI files, which supply additional information about field layouts, must describe the physical segments. The files cannot describe the logical database segment layouts.

DLIModel Utility Restrictions

The DLIModel utility has the following restrictions.

- The DLIModel utility cannot process:
  - MSDB, HSAM, SHSAM, and GSAM databases
  - Shared secondary indexes
  - PROCOPT=K option in a PSB SENSEG statement
- The DLIModel utility does not use `DLITypeInfoList` classes in its generated classes. If you want to define repeating groups of fields in segments other than by explicitly defining each group of fields separately, you must create the classes manually or modify the classes generated by the DLIModel utility.
- The default data type for all fields is CHAR, even if the DBD specifies a different data type. To change the data type of a field, use the FIELD control statement.

Output Types of the DLIModel Utility

The DLIModel utility can generate the following types of output:

- Java Metadata Class
- DLIModel IMS Java Report
- XMI Description of the Databases
- XML Schema
- DLIModel Utility Trace

Java Metadata Class

The DLIModel utility generates the necessary Java metadata source files that are needed by the Java application. However, the generated DLIModel IMS Java Report provides enough information about the IMS databases for application development.

Do not edit the generated metadata classes. Use only the DLIModel utility control statements to make changes to the classes.

For application development, use the DLIModel IMS Java Report instead of the metadata class itself for information about the metadata and the database.

Table 13 lists the control statements and parameters that are required and optional for generating Java metadata source files.

Table 13. Control Statements and Parameters to Generate Java Metadata Source Files

Control statement	Required parameters	Optional parameters
OPTIONS	GenJavaSource	JavaSourcePath
PSB	PSBName	none

DLIModel IMS Java Report

The DLIModel IMS Java Report summarizes the structure of the IMS databases in a way that helps you create Java applications and code SQL queries against the

databases. With the DLIModel IMS Java Report, you do not have to interpret Java metadata class source or refer to the DBD or PSB source.

Related Reading: Sample DLIModel IMS Java Reports are shown in each of the examples in “Examples of Using the DLIModel Utility” on page 189.

Table 14 lists the control statements and parameters that are required and optional for generating a DLIModel IMS Java Report.

Table 14. Control Statements and Parameters to Generate a DLIModel IMS Java Report

Control statement	Required parameters	Optional parameters
OPTIONS	GenJavaSource	JavaSourcePath
PSB	PSBName	none

PSB Description

In the DLIModel IMS Java Report, the name of the generated class for the PSB is provided first and is either the name defined by the JavaName parameter or, if no JavaName is specified, the 8-character PSB name. The report also shows the package for the class, if the package was specified in the OPTIONS control statement, and the PSB name.

Use the name of the metadata class to establish the connection to the database within your application code. For example:

```
connection = DriverManager.getConnection
("jdbc:dli:dealership.application.DealerDatabaseView");
```

Because the supplied string begins with `jdbc:dli:`, the JDBC `DriverManager` facility locates the `DLIDriver` instance and requests that it create a connection.

PCB Description

Within each PSB section of the report, a section is listed for each PCB. Each PCB is identified by its IMS Java name, which is either the name defined by the JavaName parameter or the 8-character PCB name from the PSB if no JavaName parameter is specified.

Use the PCB name in SQL queries to the database. In the SQL queries, the PCB name is equivalent to a table designator. For example:

```
SELECT * FROM PCBName.SegmentName
```

Segment Description

Within each PCB section of the report, all segments are listed in hierarchical sequence. Segment descriptions are indented to illustrate the hierarchical dependencies. Each segment is identified by its IMS Java name, which is either the name defined by the JavaName parameter or the 8-character segment name from the PSB if no JavaName parameter is specified.

Use the IMS Java name for the segment in SQL queries to the database. In the SQL queries, the segment name is equivalent to a table name.

Field Description

Within each segment, fields are listed in the order in which they appear in the DBD and are appended with any additional fields that were added by control statements or COBOL copybooks. Each field is identified by its IMS Java name, which is either the name defined by the JavaName parameter or the 8-character field name from the DBD if no JavaName parameter is specified.

Use the IMS Java name for the field in SQL queries to the database. In the SQL queries, the field name is equivalent to a column name.

Fields are of the following three types:

Field that is physically in a DBD
In the report, a DBD field is annotated as either a `++ Primary Key Field ++` if it is the sequence field of its segment or as a `(Search field)` if it is a non-sequence field. SQL queries with WHERE clauses qualified on primary key fields generally produce much faster response times than calls that are qualified on search fields, but both are allowed.

These fields have their IMS Java type listed, and if necessary, their type qualifier. The report also lists their length in bytes.

DBD secondary index search field
A secondary index search field is annotated as `++ Secondary Key Field ++` and, like a primary key field, produces fast responses to queries. However, secondary index search fields are not physically present in their segment and can not be retrieved from the result set. In the report, secondary index search fields are followed by a list of their component search fields to assist you in creating a suitable string to use as a search argument in an SQL query.

A secondary index field has no length value. It is essentially a virtual field and is used only for searching.

Field that is not in the DBD
A field that is not in a DBD has been added by a FIELD control statement or by a COBOL copybook XMI description. The report lists its length, data type, and, if required, type qualifier. Such a field has no key field or search field annotation in the report, which indicates that it cannot be used in an SQL WHERE clause. However, the fields can be retrieved from the result set.

XMI Description of the Databases

An XMI file written in UTF-8 encoding is produced by the DLIModel utility if you specify genXMI=YES in the OPTIONS control statement. The XMI file describes all of the PCBs and the referenced DBDs that are processed when the utility runs.

The samples directory contains samples of the XMI that is produced for each of the samples in this chapter. The XMI is converted from UTF-8 to EBCDIC encoding for viewing in a z/OS environment.

The XMI file that is produced by the utility is based on a model of the IMS database defined in UML. This model is a package with a number of inheritance relationships to the OMG Common Warehouse Metamodel (CWM). However, only the IMS package itself is included and used in the DLIModel utility.

Directory *pathprefix*/usr/lpp/ims/imsjava91/dlimodel/samples/model of the IMS Java HFS directory contains:

- An EBCDIC-encoded XMI definition of the metamodel to view in a z/OS environment.
- An IBM Rational Rose® model file of the metamodel. This model file is at the 4.5/6.0 Model level, which corresponds to Rose 98 or 98i. To view this file, you need a licensed and installed copy of a suitable level of the Rational Rose product.

Table 15 lists the control statements and parameters that are required and optional for generating an XMI description.

Table 15. Control Statements and Parameters to Generate an XMI Description

Control statement	Required parameters	Optional parameters
OPTIONS	GenXMI	XMIPath
PSB	PSBName	none

XML Schema

The generated XML schema, written in UTF-8 encoding, is an XML document that describes the XML view of an IMS database based on a PCB. An XML schema is required to retrieve XML documents from or store XML documents into IMS. IMS uses an XML schema to validate an XML document that is either being stored into or retrieved from IMS. The XML schema, not the application program, determines the structural layout of the parsed XML document in the database during storage and the generated XML document during retrieval.

Do not edit the XML schema. Make changes to the schema only by editing the control statements and running the DLIModel utility.

The schemas generated are used either for retrieval only or for both storage and retrieval. Because XML storage has restrictions that XML retrieval does not have, the schemas have an annotation that specifies whether the schema can be used for storage and retrieval or only for retrieval. The following example is an annotation from a schema that can be used for both storage and retrieval:

```
<xsd:annotation>
    <xsd:appinfo>
        <ims:DLI mode="store"/>
    </xsd:appinfo>
</xsd:annotation>
```

If you are using the generated schema for storage, the schema also specifies whether the XML is stored intact or decomposed. An element can have an annotation that specifies that the element and all of its nested elements are to be stored intact. The following example is an annotation from an element that is stored intact:

```
<xsd:annotation>
    <xsd:appinfo>
        <ims:intact />
    </xsd:appinfo>
<xsd:annotation>
```

The DLIModel utility generates an XML schema from the following input:

- DBDs
- One PSB
- COBOL copybook XMI (optional)
- Control statements

In a single run of the DLIModel utility, you can generate schemas for all PCBs in the PSB that is to be processed by the utility or for only the PCBs that you specify.

The generated XML schemas are stored in the path that you specify in the control statements. The file names have the following format:

PsbName-pcbJavaName.xsd

An XML schema of the sample dealership database is provided in the HFS directory *pathprefix*/usr/lpp/ims/imsjava91/samples/dealership/AUTPSB11-Dealer.xsd.

Table 16 lists the control statements and parameters that are required and optional for generating an XML schema.

Table 16. Control Statements and Parameters to Generate an XML Schema

Control statement	Required parameters	Optional parameters
OPTIONS	GenJavaSource GenXMLSchemas	XMLSchemaPath
PSB	PSBName	none
PCB (optional)	PCBName	GenXMLSchema XMLRootElement
FIELD (optional)	none	XMLType XMLStorageType Overflow
SIDESEG (optional)	Xpath Source Field	none

DLIModel Utility Trace

The DLIModel utility can generate a trace file named dlimodeltrace if you need to resolve a problem with the utility. For the utility to generate the trace file, specify GenTrace=YES in the OPTIONS control statement. You can also specify the path where the file is written by using the TracePath parameter.

Table 17 lists the control statements and parameters that are required and optional for generating a trace file.

Table 17. Control Statements and Parameters to Generate a Trace File

Control statement	Required parameters	Optional parameters
OPTIONS	GenTrace	TracePath

Running the DLIModel Utility

You can run the DLIModel utility in two ways:

- As a standard z/OS job, as described in “Running the DLIModel Utility as a z/OS Job” on page 175
- From the command prompt of UNIX System Services, as described in “Running the DLIModel Utility from UNIX System Services” on page 177

Prerequisites:

- Install IMS Java and download the required Apache open source XML libraries. For information about installing IMS Java and downloading the required XML files, see the *IMS Version 9: IMS Java Guide and Reference*.
- Write control statements for the DLIModel utility. These control statements are stored in an HFS file or PDS member. When you run the utility, you will provide the location and name of the HFS

file or PDS member. For information about writing the control statements, see “Control Statements for the DLIModel Utility” on page 178.

Running the DLIModel Utility as a z/OS Job

The DLIMODEL procedure is delivered as member DFSMODEL in the IMS distribution library SDFSISRC. To prepare this procedure, perform the following steps:

1. Copy the member DFSMODEL from its distribution library, SDFSISRC, to the data set from where you submit IMS procedures for batch execution.
2. Optionally, rename the procedure. These instructions assume that you have renamed the procedure DLIMODEL.

Because the DLIModel utility is a Java application, the DLIMODEL procedure runs the utility on z/OS using BPXBATCH, a z/OS-provided utility that runs any z/OS UNIX shell command or executable.

The DLIMODEL procedure has two steps:

- Step 1 executes the DLIModel utility (a Java application) by invoking the z/OS utility named BPXBATCH. The data-set name of a PDS control data set is provided to the utility through the EXEC statement PARM field. This step contains DD statements for the utility’s standard output streams, STDOUT and STDERR, which are directed to temporary HFS files. Other utility inputs and outputs are read from or sent to data sets and files with names specified by the control data set and do not have DD statements.
- Step 2 redirects STDOUT and STDERR to SYSOUT streams where they can be viewed using your usual procedures (for example, by using SDSF).

The procedure shown in Figure 54, DLIMODEL, runs the DLIModel utility using BPXBATCH:

```
//DLIMODEL PROC ABSPATH=,DSNAME=,SOUT='*'
//*********************************************************************
//* THIS PROC RUNS THE IMS JAVA UTILITY IN BATCH MODE
//*********************************************************************
//STEP1 EXEC PGM=BPXBATCH, PARM='SH cd &ABSPATH;go "&DSNAME" PDS'
//STDENV DD DUMMY
//STDOUT DD PATH='/tmp/&SYSUID..out',
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
// PATHMODE=SIRWXU
//STDERR DD PATH='/tmp/&SYSUID..err',
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
// PATHMODE=SIRWXU
//*-------------------------------------------
//* Redirect stdout and stderr output to SYSOUT:
//STEP2 EXEC PGM=IKJEFT01,DYNAMNBR=300,COND=EVEN
//SYSTSPRT DD SYSOUT=&SOUT
//HFSOUT DD PATH='/tmp/&SYSUID..out'
//HFSERR DD PATH='/tmp/&SYSUID..err'
//STDOUTL DD SYSOUT=&SOUT,DCB=(RECFM=VB,LRECL=133,BLKSIZE=137)
//STDERRL DD SYSOUT=&SOUT,DCB=(RECFM=VB,LRECL=133,BLKSIZE=137)
//SYSPRINT DD SYSOUT=&SOUT
// PEND
```

Figure 54. Sample DLIModel Utility Procedure

DLIMODEL PROC Statement Parameters

The following parameters are required for the DLIMODEL PROC statement.

ABSPATH
The fully qualified path of the go file. This script file contains the `java` command that executes the DLIModel utility class file.

Note: The go file is a script file that contains the `java` command and specifies the required JAR files needed by the application. The command uses the $ symbol. Edit the go file only if the $ symbol is not valid in your location, in which case, replace the $ symbol with an appropriate symbol.

DSNAME
The fully qualified data-set name of the top-level control data set, which contains the DLIModel utility control statements. These control statements are described in "Control Statements for the DLIModel Utility" on page 178.

DSNAME must refer to a PDS or PDSE member and not to an HFS file. The format is:

qual1.qual2.dsname(*member*)

The named data set must be type F or FB with the LRECL= parameter set to 80.

SOUT The class for all SYSOUT output in the procedure.

STEP1 EXEC Statement Parameters

PGM=BPXBATCH
Runs the BPXBATCH utility.

PARM Runs the utility as a Java application under UNIX System Services.

Step 1 DD Statements

STDENV DD
Contains the statements that set the Java environment variables. You should not need to use this DD statement.

STDOUT DD
The destination to which the BPXBATCH utility in step 1 directs standard output. This output includes messages that record the normal execution of the utility. This output is redirected by step 2 to the standard SYSOUT destination.

STDERR DD
The destination to which the BPXBATCH utility in step 1 directs standard error output. This output includes error and warning messages that are related to the execution of the utility. This output is redirected by step 2 to the standard SYSOUT destination.

SYSTSIN DD
Control statements for the z/OS utility IKJEFT01 to copy the temporary HFS output files to the SYSOUT destination.

Step 2 EXEC Statement Parameters

PGM=IKJEFT01
Runs the z/OS utility IKJEFT01, which redirects STDOUT data and STDERR data to the SYSOUT destination.

DYNAMNBR
See the *z/OS: UNIX System Services User's Guide* and *z/OS: UNIX System Services Command Reference*.

COND
See the *z/OS: UNIX System Services User's Guide* and *z/OS: UNIX System Services Command Reference*.

Step 2 DD Statements

SYSTEPRT DD
IKJEFT01 utility output.

HFSOUT DD
Input from the temporary STDOUT file from step 1.

HFSERR DD
Input from the temporary STDERR file from step 1.

STDOUTL DD
Output destination for the STDOUT stream.

STDERRL DD
Output destination for the STDERR stream.

SYSPRINT DD
IKJEFT01 utility output.

SYSTSIN DD
Must be added to the execution JCL. See Figure 55 for an example. The SYSTSIN DD statement provides control statement input for the IKJEFT01 utility that redirect HFSOUT and HFSERR streams to the STDOUTL and STDERRL destinations. For example:

```
OCOPY INDD(HFSOUT) OUTDD(STDOUTL)
OCOPY INDD(HFSERR) OUTDD(STDERRL)
```

Related Reading: For more information about the z/OS BPXBATCH utility, see the *z/OS: UNIX System Services User's Guide* and the *z/OS: UNIX System Services Command Reference*.

Figure 55 is an example of a job that runs the DLIMODEL procedure:

```
//BPXAUTP6 JOB CLASS=Z,MSGCLASS=E,MSGLEVEL=(1,1),
//     TIME=(9),USER=OMVSADM,PASSWORD=xxxxxxx,
//     REGION=32M
//TEST EXEC DLIMODEL,DSNAME='qual1.qual2.dsname(CNTRSTMT)',
//                   ABSPATH='pathprefix/usr/lpp/ims/imsjava91/dlimodel'
//STEP2.SYSTSIN DD *
OCOPY INDD(HFSOUT) OUTDD(STDOUTL)
OCOPY INDD(HFSERR) OUTDD(STDERRL)
/*
```

Figure 55. JCL Job to Run the DLIMODEL Procedure

In this example, the IKJEFT01 SYSTSIN DD statement is provided with control statements to copy the temporary HFS outputs to SYSOUT destinations.

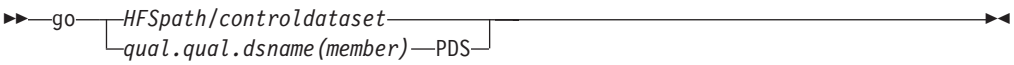
Running the DLIModel Utility from UNIX System Services

In addition to using the JCL procedure, you can run the DLIModel utility from a prompt under UNIX System Services. You can use this method if you are more familiar with a UNIX environment than with JCL.

Running the DLIModel Utility

Before running the DLIModel utility from the UNIX System Services prompt, ensure that your PATH environment variable is set so that the SDK 1.3.1 `java` command is accessible.

To run the DLIModel utility, enter the `go` command from the /imsjava91/dlimodel directory. Use the following syntax:



go The script file that contains the `java` command to execute the DLIModel application class.

Note: The go file is a script file that contains the `java` command and specifies the required JAR files needed by the application. The JAR files are found in the /imsjava91/dlimodel and /imsjava91/lib directories. The command uses the $ symbol. Edit the go file only if the $ symbol is not valid in your location, in which case, replace the $ symbol with an appropriate symbol.

HFSpath/controldataset
HFS file of the control data set.

qual.qual.dsname(member)
PDS file for the control data set.

PDS
Specifies that the control data set is a PDS file and not an HFS file.

Control Statements for the DLIModel Utility

You must write control statements to specify certain options such as input and output data set names, and which PSB and PCBs to use. You can also use the control statements to supply information to the utility about the databases that are not in the PSB, DBDs, or COBOL copybook XMI file.

The control statements are supplied to the utility in a PDS member named in the EXEC statement PARM field of the JCL, or in an HFS file named in a command line parameter in the UNIX System Services environment.

Control Data Set Rules

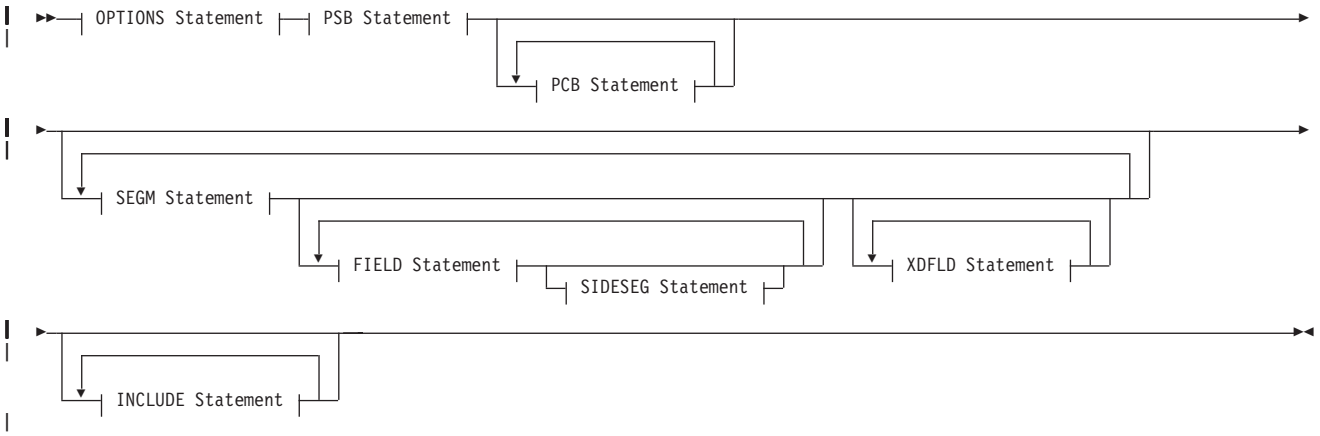
You must include the following statements in your control data set:

- OPTIONS Statement
- PSB Statement

Optionally, you can include the following statements in the control data set:

- PCB Statement
- SEGM Statement
- FIELD Statement
- SIDESEG Statement
- XDFLD Statement
- INCLUDE Statement

The following syntax diagram shows how to organize the control statements in the control data set.



A typical reason to include PCB, SEGM, and FIELD statements is to assign a customized name (alias) to these entities that can be used in your Java program or XML schema. You can choose a name that is more meaningful than the 8-character name given to these entities in the DBD and PSB source. You might also need to assign data types to fields and define additional fields that are important to your application but were not defined in the segment in the DBD.

You do not need to include PCB, SEGM, or FIELD statements in your control statement set if all of the following statements are true of your application:

- It can process PCBs, segments, and fields by their 8-character IMS names.
- It needs only fields that are defined in the DBD.
- All fields can be processed as data type CHAR.
- All PCBs in the PSB have the same GenXMLSchema option.
- If generating an XML schema, the XML root element is the database root.
- If generating an XML schema, all fields are to be elements in the schema.
- If generating an XML schema, the storage type is decomposed.

Related Reading: For examples of control data sets, see the examples in "Examples of Using the DLIModel Utility" on page 189.

The rules for ordering the control statements are as follows:

- The OPTIONS statement must be first, and must be present only in a top-level control data set.
- PCB statements must follow immediately after the PSB statement. They may be in any order (for example, PCB statements do not need to be in the same order as they appear in the original PSB source).
- FIELD statements must follow immediately after the SEGM for the physical segment to which they belong. However, FIELD statements may be in any order within their segment group. For example, FIELD statements need not be in the same sequence as they appear in the original DBD source. FIELD statements for existing fields and for new fields may be intermixed or grouped in any sequence.
- SIDESEG statements must immediately follow a FIELD statement.
- INCLUDE statements can be positioned anywhere in a control data set, but not between:
  - A PSB statement and any PCB statements that belong to it

– A SEGM statement and any FIELD statements that belong to it

You can nest multiple control data sets by using the INCLUDE statement. Nesting gives you the flexibility to store your control statements across multiple HFS files or PDS members for increased convenience and control.

For example, a top-level file could contain the OPTIONS, PSB, and PCB statements that specify a certain Java-class generation. Included files might each contain a group of SEGM and FIELD statements that relate to an individual logical or physical DBD. You can reuse these included files without change for other PSBs that reference the same databases and segments.

For an example of control statements that use the INCLUDE statements, see Figure 67 on page 194.

Control Statement Rules

The syntax for the control statements is very flexible. Each statement consists of an identifier followed by keyword parameters. The identifier may start in any column. Each identifier, keyword, and variable must be separated by at least one blank character, unless the identifiers, keywords, and variables are already separated by an operator. You can specify keyword parameters in any order.

If your control statements are in a data set, map the statements to multiple 80-character records, between columns 1 and 72, inclusive. Columns 73 through 80 are ignored. You can use these columns for sequence numbers. No continuation characters are required.

If your control statements are in an HFS file, any line length is acceptable, but you can also optionally continue statements across multiple lines as in a data set. If you restrict your line length to less than 73 characters, your control statements can be moved between data sets and HFS files without change.

Identifiers, keywords, and predefined parameter values (such as YES and NO) can appear in uppercase or lowercase characters. Other parameter values (for example, user-specified path or Java names) are case sensitive.

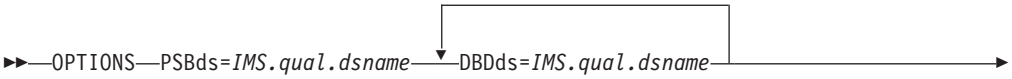
Control Statement Syntax

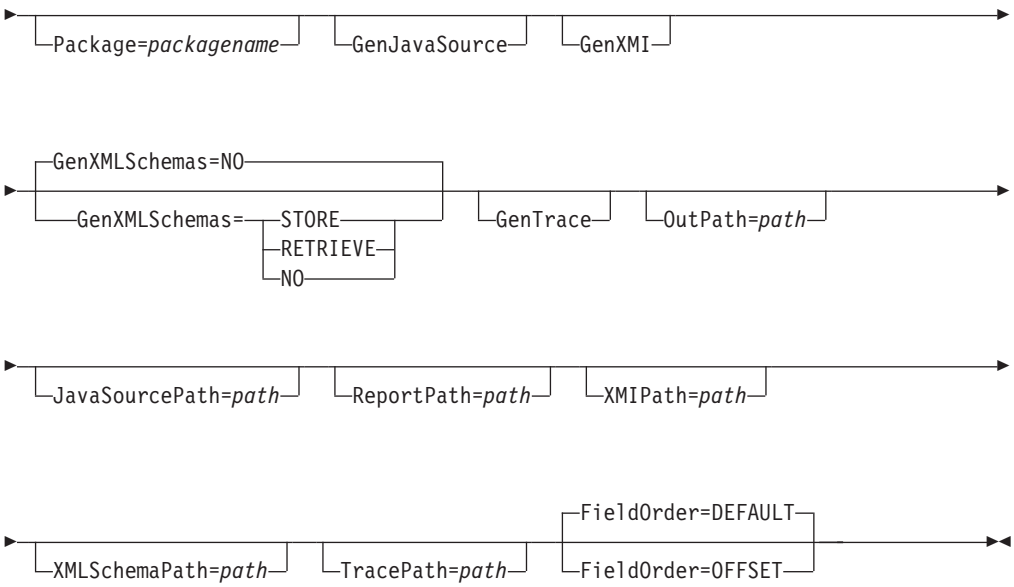
This topic describes the syntax of the DLIModel utility control statements.

OPTIONS Statement

To run the DLIModel utility, you need one OPTIONS control statement. The OPTIONS control statement customizes the DLIModel utility by specifying where to find input, what output to generate, and where to write the output.

The following diagram shows the syntax of the OPTIONS statement.





PSBds=*IMS.qual.dsname*
Required parameter specifies the data set name of the PSB source. This parameter specifies the data set name only. Specify the PSB name with the PSBName= parameter of the PSB statement. See “PSB Statement” on page 183.

DBDds=*IMS.qual.dsname*
Required parameter specifies the data set name of the DBD source. If you specify multiple parameters, the DLIModel utility opens and searches the data sets in the order that the DBDs are specified in the control statement by the DBDds parameters. This searching order is similar to data set concatenation in a JCL DD statement.

Package=*packagename*
Optional parameter specifies the package for which the IMS Java classes are generated. A Java package statement is added to each Java source file that is generated.

GenJavaSource
Optional parameter to generate the IMS Java class source files and a DLIModel IMS Java Report. This keyword is required if you specify the GenXMLSchemas parameter. If you do not specify the GenJavaSource parameter, no Java class files are generated.

Note: GenJavaSource=NO is equivalent to not including the GenJavaSource parameter.

GenXMI
Optional parameter to generate an XMI file named dlimodelxmi.xmi, which describes the database model based on the PSB and corresponding databases processed by the utility. If you do not specify GenXMI, no XMI file is generated.

Note: GenXMI=NO is equivalent to not including the GenXMI parameter.

GenXMLSchemas=NO| STORE | RETRIEVE
Optional parameter specifies the default value for generating XML schemas for PCBs in the PSB source. If you specify GenXMLSchemas=STORE or GenXMLSchemas=RETRIEVE, you must also specify GenJavaSource. If you

specify the GenXMLSchema parameter in a PCB statement, the specified parameter overrides the default parameter for that PCB. For more information on the PCB statement, see “PCB Description” on page 171.

NO Specifies that no XML schemas are generated by the utility. NO is the default.

STORE
Specifies that XML documents that conform to the generated XML schema can be stored in or retrieved from the database. To store XML, the PCB that the XML schema is based on must meet the following requirements:

- The PCB is based on a physical DBD.
- No segments in the hierarchy are logical children.
- The hierarchy is based on a primary database root key and not on a secondary index.
- No segments have the parameter PROCOPT=K.

RETRIEVE
Specifies that applications can use only the `retrieveXML` field and not `storeXML` field with this XML schema and its corresponding PCB. If you specify GenXMLSchemas=RETRIEVE, you cannot store XML documents in the IMS database. However, if you specify GenXMLSchemas=RETRIEVE, the PCB and database restrictions that specify GenXMLSchemas=STORE do not apply.

GenTrace
Optional parameter to generate a trace file, named dlimodeltrace, of the utility run. If you do not specify GenTrace, no trace file is generated.

Note: GenTrace=NO is equivalent to not including the GenTrace parameter.

OutPath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the output files, unless you specify path names for specific output files. The default output path is the current directory.

JavaSourcePath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the IMS Java class files. This parameter overrides the OutPath parameter.

ReportPath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the DLIModel IMS Java Report. This parameter overrides the OutPath parameter.

XMIPath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the generated XMI. This parameter overrides the OutPath parameter.

XMLSchemaPath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the generated XML schema. This parameter overrides the OutPath parameter.

TracePath=*path*
Optional parameter specifies the HFS directory where the DLIModel utility writes the trace file. This parameter overrides the OutPath parameter.

FieldOrder=DEFAULT | OFFSET
Optional parameter specifies the order of the fields of segments in the generated IMS Java class.

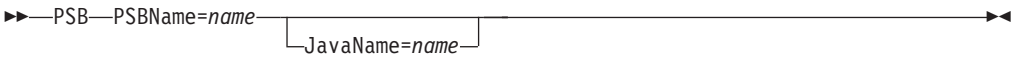
DEFAULT
Fields are in the same order as in the DBD and are followed by any new fields that are defined by the control statements.

OFFSET
Fields are in the order of their start positions.

PSB Statement

The PSB statement is required in order to run the DLIModel utility because it defines which PSB the utility uses.

The following diagram shows the syntax of the PSB statement.



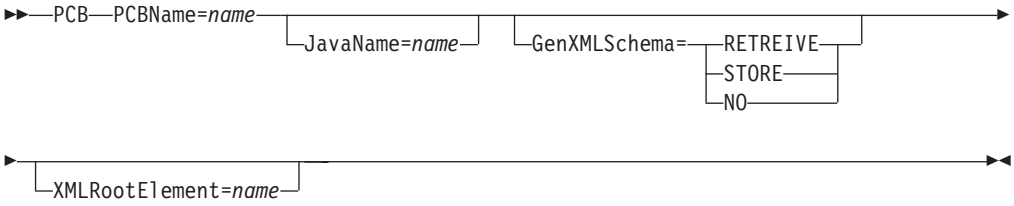
PSBName=*name*
Required parameter specifies the name of the PSB that is used by the DLIModel utility.

JavaName=*name*
Optional parameter specifies the name of the generated Java metadata class. If you do not specify this parameter, the name of the Java metadata class is the same as the PSB name.

PCB Statement

The PCB statement is optional unless the PCB name is an SQL keyword. With the PCB statement, you can specify an alias for a PCB and whether to generate an XML schema for a PCB. All PCB statements for a PSB must follow the PSB statement.

The following diagram shows the syntax of the PCB statement.



PCBName=*name*
Optional parameter specifies the 8-character PCB name that you want to assign an alias to.

JavaName=*name*
Optional parameter specifies the Java alias for the PCB, which is used in the Java application or the XML schema. The name must be unique for each PSB and cannot be an SQL keyword.

GenXMLSchema=NO | STORE | RETRIEVE
Optional parameter specifies whether to generate an XML schema for this PCB. When specifying GenXMLSchema=STORE or GenXMLSchema=RETRIEVE,

you must also specify GenJavaSource=YES. This parameter overrides the GenXMLSchema parameter in the OPTIONS statement, which determines the default for this parameter.

NO Specifies that no XML schema will be generated for this PCB.

STORE
Specifies that XML documents that conform to the generated XML schema can be stored in or retrieved from the database. To store XML, the PCB that the XML schema is based on must have the following requirements:

- The PCB is based on a physical DBD.
- No segments in the hierarchy are logical children.
- The hierarchy is based on a primary database root key and not on a secondary index.
- No segments have the parameter PROCOPT=K.

RETRIEVE
Specifies that the XML documents that conform to the generated XML can be retrieved only from a database. You cannot store XML documents, but the restrictions on GenXMLSchemas=STORE do not apply.

XMLRootElement=*name*
Specifies which segment is the root element in the XML schema. The `retrieveXML` UDF can use the specified segment, or any dependent segment of the specified segment, as an argument. The default root element is the root segment of the database. This parameter is ignored if you specify GenXMLSchema=NO.

SEGM Statement

The SEGM statement is optional unless the segment name is an SQL keyword. The SEGM statement is used for physical and logical segments.

For physical segments, the SEGM statement:

- Identifies a physical segment in a DBD.
- Supplies a Java alias for the segment.
- Specifies a COBOL copybook XMI file that contains additional information about the segment.
- Specifies whether a segment is the primary segment for an intact XML document.
- Groups the FIELD statements that follow the SEGM statement.

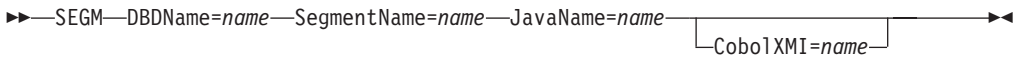
or logical segments, the SEGM statement:

- Identifies a logical segment in a logical DBD.
- Specifies a Java alias for the segment.
- Cannot be followed by any FIELD statements.

If the DLIModel utility cannot find the segment, it issues a warning instead of an error and ignores any subsequent FIELD statements. Because the utility issues only an error, you can create control statement files that provide information about many segments and their fields, even if they are not all used by the particular PSB being processed.

If a COBOL copybook XMI file is named for a segment, the fields that it defines are merged by name with the fields that are defined in the DBD.

The following diagram shows the syntax of the SEGM statement.



DBDName=*name*
Required parameter specifies the 8-character DBD name where the segment is defined.

SegmentName=*name*
Required parameter specifies the segment name in the DBD.

JavaName=*name*
Required parameter specifies the alias for the segment, which will be used in the Java application and XML schema. Must be unique for each DBD. Overrides any value that might have been set from a COBOL XMI file.

CobolXMI=*name*
Optional parameter specifies name of a COBOL copybook XMI file that may provide additional information about the segment and its existing fields, and definitions of new fields. XMI input is only allowed for physical segments.

FIELD Statement

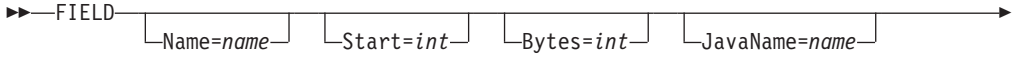
The FIELD statement is optional unless the field name is an SQL keyword. It specifies information about a field or defines a new field for a segment in a physical DBD. All FIELD statements for a segment must immediately follow the SEGM statement. However, FIELD statements can be in any order and mixed with XDFLD statements.

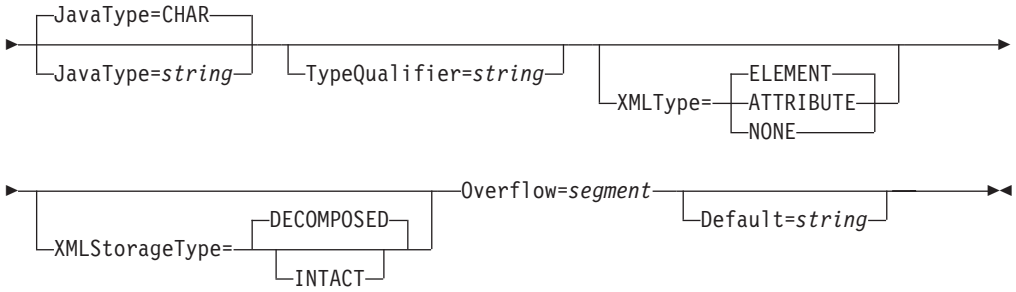
When adding information for an existing DBD field, you must specify the 8-character DBD name of the field using the Name parameter. You can optionally specify the starting position (Start parameter) and length (Bytes parameter) of the field. If you do, DLIModel utility checks these values against the DBD and produces an error message if they do not match.

To add information to a non-DBD field that has been added by a COBOL copybook XMI file, specify a Java name that matches the name of the copybook field using the JavaName parameter. Do not specify a DBD 8-character field name using the Name parameter.

To define a new field in the segment, do not specify a DBD 8-character field name. Instead, specify a unique Java name that does not match any Java field name in the segment using the JavaName parameter. For the new field, you must also specify a starting position, using the Start parameter), and a length, using the Bytes parameter. You can include other attributes, such as data type or default value, for the new field.

The following diagram shows the syntax of the FIELD statement.





Name=*name*
Specifies the 8-character field name as defined in the DBD. This name must be unique within the segment. This parameter identifies this control statement as applying to an existing field within the DBD. Do not use this parameter to define a new field.

Start=*int*
Specifies the starting position of the field in the segment. The first byte in the segment is 1. The Start parameter is required for new fields and optional for existing fields.

Bytes=*int*
Specifies the length of the field in the segment. The Bytes parameter is required for new fields and optional for existing fields.

JavaName=*name*
Specifies the alias for the field. This name cannot be an SQL keyword. Aliases of Field statements and XDFLD statements must be unique within a segment. The JavaName parameter is required to define a new field and is optional for existing fields. If this name matches the name of a field in a COBOL copybook XMI file, this FIELD statement applies to that COBOL copybook field.

JavaType=*string*
Optional parameter specifies the JDBC type of the field. The default JDBC type is CHAR, even if a different type is specified in the DBD. If you specify XMLStorageType=INTACT, you must specify JavaType=CLOB. If you specify JavaType=CLOB, you must also specify an overflow segment with the Overflow= parameter. The JDBC type can be any of the following:
- CHAR
- CLOB
- FLOAT
- DOUBLE
- SMALLINT
- INTEGER
- BIGINT
- ZONEDDECIMAL
- TIME
- VARCHAR
- TINYINT
- BIT
- TYPELIST
- BINARY
- PACKEDDECIMAL
- DATE
- TIMESTAMP

The value that you specify overrides any value set by the COBOL copybook XMI file.

TypeQualifier=*string*
Required parameter specifies the type qualifier for the following JDBC types:
PACKEDDECIMAL
ZONEDDECIMAL
DATE
TIME
TIMESTAMP

The value that you specify is ignored if you specify any other JDBC type for the JavaType parameter.

Related Reading: For more information about determining the syntax of type qualifiers, see *IMS Version 9: IMS Java Guide and Reference*.

XMLType= ELEMENT | ATTRIBUTE | NONE
If the DLIModel utility is generating an XML schema, XMLTYPE= specifies whether the field is represented as a simple element or as an attribute in the resulting XML documents, or whether the field is excluded completely from the XML documents.

ELEMENT Field is an element that is contained within the segment element. XMLType=ELEMENT is the default.

ATTRIBUTE Field is an attribute of the segment element.

NONE Field is excluded from the generated XML schema. You cannot specify NONE for primary key fields when you specify GenXMLSchema=STORE. If the XML schema type is *store*, the IMS Java default value is used during a storeXML operation for the field labeled XMLType=NONE.

XMLStorageType= DECOMPOSED | INTACT
Optional parameters specifies whether the field represents the primary field of an intact XML structure in the database.

DECOMPOSED
When you specify DECOMPOSED, XML tags are added to the information when you compose XML from the field data, and XML tags are removed from an XML element or attribute before the data is stored into the field. DECOMPOSED is the default.

INTACT
When you specify INTACT for this parameter, the field represents the primary field of an intact XML document in the database. The XML element or attribute that corresponds to this field has an intact annotation in the generated XML schema. If you specify INTACT for this parameter, you must also specify an overflow segment with the Overflow= parameter.

Overflow=*segment*
Optional parameter specifies the name of the overflow segment for intact XML storage. You must specify an overflow segment with this parameter if you specify JavaType=CLOB.

Default=*string*
Optional parameter specifies the default value for the field. The default value is used for new instances of the segment when an application does not define a value for the field. The string must be formatted to match the data type qualifier properties of the field.

SIDESEG Statement

The SIDESEG statement is optional. It specifies a child segment that contains the secondary index of intact XML documents. If you specify a SIDESEG statement, it must follow a FIELD statement that has the XMLStorageType=INTACT parameter.

The following diagram shows the syntax of the SIDESEG statement.

XPath=*expression*
Specifies the XPath expression for the secondary index segment.

Source=*segment*
Specifies the name (Java name or 8–character IMS name) of the secondary index segment, which must be an immediate child of the segment that contains the primary field of an intact XML document.

KeyField=*field*
Specifies the name (Java name or 8–character IMS name) of the key field in the secondary index segment.

XDFLD Statement

The XDFLD statement is optional. It specifies a Java alias for an existing secondary index field in a segment. The XDFLD statements must follow the SEGM statement that corresponds to the segment with the secondary indexes in the DBD.

You must identify a secondary index field, which must be an existing field that was defined in the DBD, by the 8-character name because secondary index fields do not have a starting position in the segment. Secondary index fields do not have a data type. Therefore, you must create a single string that contains the concatenated search fields, each correctly encoded for its data type, when using the index field in a SELECT statement. An index field cannot be fetched from the JDBC result set.

The following diagram shows the syntax of the XDFLD statement.

Name=*name*
Required parameter specifies the 8-character name of the secondary index field, as defined in the DBD.

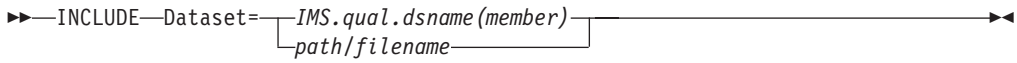
JavaName=*name*
Required parameter specifies the Java alias for the secondary index field.

INCLUDE Statement

The INCLUDE statement is optional and is allowed only in the top-level control statement data set. The INCLUDE statement specifies a PDS member or HFS file of additional control statements to be included in the top-level data set. The included data set must be the same type (PDS or HFS) as the top-level data set. You are allowed any number of INCLUDE statements in the top-level data set.

Important: Do not put an INCLUDE statement between PSB statements and PCB statements or between SEGM statements and FIELD statements. INCLUDE statements between these statements break the required relationship between them.

The following diagram shows the syntax for the INCLUDE statement.



Dataset=*IMS.qual.dsname(member)* | *path/filename*
Required parameter specifies the PDS member or HFS file that has the control statements that are to be included in the top-level data set.

Comment Statement

The Comment Statement is optional. Just as in Java code, it indicates that a line in the PDS member is a comment. For example:

```
// The two slashes indicate that this line is a comment.
```

Examples of Using the DLIModel Utility

This section shows examples of how the DLIModel utility uses DBDs, PSBs, and control statements to create IMS Java classes and DLIModel IMS Java Reports.

The examples in this section are in the following default directories:

```
pathprefix/usr/lpp/ims/imsjava91/dlimodel/samples/ivpJMP/
pathprefix/usr/lpp/ims/imsjava91/dlimodel/samples/ivpJBP/
pathprefix/usr/lpp/ims/imsjava91/dlimodel/samples/dealership/
pathprefix/usr/lpp/ims/imsjava91/dlimodel/samples/cobolXMI/
```

The samples are in the compressed *pathprefix*/usr/lpp/ims/imsjava91/dlimodel/samples.tar file. To uncompress the samples.tar file, issue the following command from the UNIX Systems Services prompt while in the /dlimodel directory:

```
tar -xvf samples.tar
```

You can also use the BPXBATCH utility to uncompress the samples.tar file:

```
//JOB     parameters
//UNTAR    EXEC PGM=BPXBATCH,
// PARM='sh cd pathPrefix/usr/lpp/ims/imsjava91/dlimodel/tar -xvf samples.tar'
//SYSPRINT DD  SYSOUT=*
//STDOUT   DD  PATH='path/untar.out',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),PATHMODE=SIRWXU
//STDERR   DD  PATH='path/untar.err',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),PATHMODE=SIRWXU
//*
```

JMP IVP Metadata Sample

You can generate the IMS Java metadata class that is needed to run the JMP IVP by using the input files in *pathprefix*/usr/lpp/ims/imsjava91/dlimodel/samples/ivpJMP. After you run the utility, you can compare the generated file with the IMS Java-provided file in *pathprefix*/usr/lpp/ims/imsjava91/samples/ivp.

After you compile it, you can use the IMS Java metadata source file DFSIVP37DatabaseView.java for the IMS Java IVP on WebSphere Application Server, DB2 UDB for z/OS, and CICS.

Figure 56 on page 190 shows the DBD for the IVP database. The DBD is referenced by the PSB that is shown in Figure 57 on page 190, which has a single PCB and one sensitive segment.

```
DBD    NAME=IVPDB2,ACCESS=HDAM,RMNAME=(DFSHDC40,40,100)
DATASET DD1=DFSIVD2,DEVICE=3380,SIZE=2048
SEGM   NAME=A1111111,PARENT=0,BYTES=40,RULES=(LLL,LAST)
FIELD  NAME=(A1111111,SEQ,U),BYTES=010,START=00001,TYPE=C
DBDGEN
END
```

Figure 56. DBD for the IVP Database

```
PHONEAP  PCB TYPE=DB,DBDNAME=IVPDB2,PROCOPT=A,KEYLEN=10
         SENSEG NAME=A1111111,PARENT=0,PROCOPT=AP
         PSBGEN LANG=JAVA,PSBNAME=DFSIVP37
         END
```

Figure 57. PSB for the JMP IVP

Note that the PCB is given a name, as required by IMS Java. In this case, a label is used, but a PCBNAME= parameter is also acceptable.

The JMP IVP control data set named contrstmt is shown in Figure 58.

```
OPTIONS PSBds=IMS.TEST1.PSBSRC
        DBDds=IMS.TEST1.DBDSRC
        GenJavaSource
        OutPath=samples/ivpJMP
        Package=samples.ivp
        GenTrace
PSB     PSBName=DFSIVP37 JavaName=DFSIVP37DatabaseView
PCB     PCBName=PHONEAP JavaName=PhoneBook
SEGM    DBDName=IVPDB2 SegmentName=A1111111 JavaName=Person
FIELD   Name=A1111111 Start=1 Bytes=10 JavaName=LastName JavaType=CHAR
FIELD   Start=11 Bytes=10 JavaName=FirstName JavaType=CHAR
FIELD   Start=21 Bytes=10 JavaName=Extension JavaType=CHAR
FIELD   Start=31 Bytes=7 JavaName=ZipCode JavaType=CHAR
```

Figure 58. Control Data Set for JMP IVP

The DLIModel utility processes a single PSB named DFSIVP37 and its DBD, IVPDB2. The utility reads the PSB and DBD from data sets IMS.TEST1.PSBSRC and IMS.TEST1.DBDSRC. The name of the generated class is DFSIVP37DatabaseView and the class is written to the HFS file, DFSIVP37DatabaseView.java, under the current directory. STDOUT is redirected to SYSOUT, but in the absence of errors consists of only startup and normal completion messages. The DLIModel IMS Java Report, which is produced whenever IMS Java classes are generated, is written to the HFS file DFSIVP37JavaReport.txt.

The DLIModel IMS Java Report that is shown in Figure 59 on page 191 describes the generated IMS Java metadata class DFSIVP37DatabaseView.

```
DLIModel IMS Java Report
========================
Class: DFSIVP37DatabaseView  in package: samples.ivp  generated for PSB: DFSIVP37


================================================
PCB: PhoneBook
================================================
Segment: Person
Field: LastName         Type=CHAR       Length=10 ++ Primary Key Field ++
Field: FirstName        Type=CHAR       Length=10
Field: Extension        Type=CHAR       Length=10
Field: ZipCode          Type=CHAR       Length=7
```

Figure 59. DLIModel IMS Java Report for JMP IVP

In this DLIModel IMS Java Report, the class name, DFSIVP37DatabaseView, is based on the IMS PSB name. Also, the PCB name, DFSIVP37, is the same as the label in the PSB PCB statement.

Each field line displays the length and type of the field. Because there are no control statements or COBOL copybook XMI files that specify otherwise, the type of all fields defaults to CHAR.

JBP IVP Metadata Sample

You can generate the IMS Java metadata class that is needed to run the JBP IVP by using the input files in *pathprefix*/usr/lpp/ims/imsjava91/dlimodel/samples/ivpJBP. After you run the utility, you can compare the generated file with the IMS Java-provided file in *pathprefix*/usr/lpp/ims/imsjava91/samples/ivp.

After you compile the IMS Java metadata source file DFSIVP67DatabaseView.java, you can use it for the IMS Java IVP in only a JBP region.

Figure 60 shows the DBD for the IVP database.

```
DBD    NAME=IVPDB2,ACCESS=HDAM,RMNAME=(DFSHDC40,40,100)
DATASET DD1=DFSIVD2,DEVICE=3380,SIZE=2048
SEGM   NAME=A1111111,PARENT=0,BYTES=40,RULES=(LLL,LAST)
FIELD  NAME=(A1111111,SEQ,U),BYTES=010,START=00001,TYPE=C
DBDGEN
END
```

Figure 60. DBD for the IVP Database

The DFSIVP67 PSB references the IVP DBD. The PSB has a single PCB and one sensitive segment, shown in Figure 61.

```
PHONEAP  PCB TYPE=DB,DBDNAME=IVPDB2,PROCOPT=A,KEYLEN=10
         SENSEG NAME=A1111111,PARENT=0,PROCOPT=AP
         PSBGEN LANG=JAVA,PSBNAME=DFSIVP67
         END
```

Figure 61. PSB for the JBP IVP

The PCB in the PSB has a name, which is required by IMS Java. You can use a label, as is shown in Figure 61, or the PCBNAME= parameter to name the PCB.

The DLIModel utility control data set, named contrstmt, is shown in Figure 62.

```
OPTIONS PSBds=IMS.TEST1.PSBSRC
        DBDds=IMS.TEST1.DBDSRC
        GenJavaSource
        Outpath=samples/ivpJBP
        Package=samples.ivp
        GenTrace
PSB     PSBName=DFSIVP67 JavaName=DFSIVP67DatabaseView
PCB     PCBName=PHONEAP JavaName=PhoneBook
SEGM    DBDName=IVPDB2 SegmentName=A1111111 JavaName=Person
FIELD   Name=A1111111 Start=1 Bytes=10 JavaName=LastName JavaType=CHAR
FIELD   Start=11 Bytes=10 JavaName=FirstName JavaType=CHAR
FIELD   Start=21 Bytes=10 JavaName=Extension JavaType=CHAR
FIELD   Start=31 Bytes=7 JavaName=ZipCode JavaType=CHAR
```

Figure 62. Control Data Set for JBP IVP

The DLIModel utility processes the PSB named DFSIVP67 and its DBD named IVPDB2. The utility reads the PSB and DBD from data sets IMS.TEST1.PSBSRC and IMS.TEST1.DBDSRC. The name of the generated class is DFSIVP67DatabaseView and the class is written to the HFS file, DFSIVP37DatabaseView.java, in the current directory. STDOUT is redirected to SYSOUT, but in the absence of errors, consists of only startup and normal completion messages. The DLIModel IMS Java Report, which is produced whenever IMS Java classes are generated, is written to the HFS file DFSIVP67JavaReport.txt.

The DLIModel IMS Java Report, shown in Figure 63, describes the generated IMS Java metadata class DFSIVP67DatabaseView.

```
DLIModel IMS Java Report
========================
Class: DFSIVP67DatabaseView  in package: samples.ivp  generated for PSB: DFSIVP67


================================================
PCB: PhoneBook
================================================
Segment: Person
Field: LastName         Type=CHAR       Length=10       ++ Primary Key Field ++
Field: FirstName        Type=CHAR       Length=10
Field: Extension        Type=CHAR       Length=10
Field: ZipCode          Type=CHAR       Length=7
```

Figure 63. DLIModel IMS Java Report for JBP IVP

Sample Metadata with COBOL Copybook XMI

This example uses the physical database DBD in Figure 64 on page 193 and PSB in Figure 65 on page 193 to show control statements and a COBOL XMI file that adds additional fields and additional name and data type information to the metadata. This example also shows how control statements can be split across more than one file.

```
DBD NAME=DEALERDB,ACCESS=(HDAM,OSAM),RMNAME=(DFSHDC40.1.10)
SEGM NAME=DEALER,PARENT=0,BYTES=94
FIELD NAME=(DLRNO,SEQ,U),BYTES=4,START=1,TYPE=C
FIELD NAME=DLRNAME,BYTES=30,START=5,TYPE=C
SEGM NAME=MODEL,PARENT=DEALER,BYTES=43
FIELD NAME=(MODTYPE,SEQ,U),BYTES=2,START=1,TYPE=C
FIELD NAME=MAKE,BYTES=10,START=3,TYPE=C
FIELD NAME=MODEL,BYTES=10,START=13,TYPE=C
FIELD NAME=YEAR,BYTES=4,START=23,TYPE=C
FIELD NAME=MSRP,BYTES=5,START=27,TYPE=P
SEGM NAME=ORDER,PARENT=MODEL,BYTES=127
FIELD NAME=(ORDNBR,SEQ,U),BYTES=6,START=1,TYPE=C
FIELD NAME=LASTNME,BYTES=25,START=50,TYPE=C
FIELD NAME=FIRSTNME,BYTES=25,START=75,TYPE=C
SEGM NAME=SALES,PARENT=MODEL,BYTES=113
FIELD NAME=(SALDATE,SEQ,U),BYTES=8,START=1,TYPE=C
FIELD NAME=LASTNME,BYTES=25,START=9,TYPE=C
FIELD NAME=FIRSTNME,BYTES=25,START=34,TYPE=C
FIELD NAME=STKVIN,BYTES=20,START=94,TYPE=C
SEGM NAME=STOCK,PARENT=MODEL,BYTES=62
FIELD NAME=(STKVIN,SEQ,U),BYTES=20,START=1,TYPE=C
FIELD NAME=COLOR,BYTES=10,START=37,TYPE=C
FIELD NAME=PRICE,BYTES=5,START=47,TYPE=C
FIELD NAME=LOT,BYTES=10,START=53,TYPE=C
DBDGEN
FINISH
END
```

Figure 64. Physical DBD for COBOL Copybook XMI Example

```
DLRPCB1 PCB TYPE=DB,DBDNAME=DEALERDB,PROCOPT=GO,KEYLEN=42
      SENSEG NAME=DEALER,PARENT=0
      SENSEG NAME=MODEL,PARENT=DEALER
      SENSEG NAME=ORDER,PARENT=MODEL
      SENSEG NAME=SALES,PARENT=MODEL
      SENSEG NAME=STOCK,PARENT=MODEL
      PSBGEN PSBNAME=AUTPSB4,MAXQ=200
      END
```

Figure 65. PSB for COBOL Copybook XMI Example

The example is run from the UNIX System Services command prompt, as shown in Figure 66. This example assumes that you are running it from the directory *pathprefix*/usr/lpp/ims/imsjava91/dlimodel.

```
> java com.ibm.ims.metagen.DLIModel samples/cobolXMI/cntrstmt
```

Figure 66. UNIX System Services Command for COBOL Copybook XMI Example

The top-level control statement file, cntrstmt, is shown in Figure 67 on page 194.

```
OPTIONS

     PSBds=IMS.TEST1.PSBSRC
     DBDds=IMS.TEST1.DBDSRC
     GenJavaSource
     GenTrace
     Package=com.ibm.ims.tooling

PSB PSBName=autpsb4 JavaName=DealerDatabaseView
PCB PCBName=DLRPCB1 JavaName=DealershipDB
INCLUDE Dataset=samples/example4/cntrstm2
```

Figure 67. Top-Level Control Data Set for COBOL Copybook XMI Example

This control statement file establishes the options for the execution. It names the PSB that is to be processed, assigns a Java name for the generated class for this PSB, and provides a Java name for a PCB in that PSB.

This example includes a second-level control statement file called cntrstm2, which is shown in Figure 68 on page 195, and a COBOL copybook XMI file. This control statement file and the COBOL copybook XMI file provide details about additional fields in the segments of the database that is referenced from DLRPCB1 and additional information about existing fields in that database. Note these facts about this second-level control statement file:

- The information it contains is necessary only because there are additional facts about the segments in this database that are needed by this hypothetical Java application. If your DBD names all the fields that are used by your application, and if all of the fields can be treated as CHAR data type, and if your application can use the standard 8-character names, you do not need to supply SEGM or FIELD control statements.
- The SEGM and FIELD control statements need to be split off into a second file only if it is convenient to do so, perhaps because this additional segment information needs to be shared by other applications. In such cases, you might group all field information for a whole database (as is shown in Figure 68 on page 195) or for each segment into its own file. If a second-level control statement file is not advantageous for your data, it is equally acceptable to place all control statements in a single, top-level file.

```
SEGM DBDName=DEALERDB SegmentName=DEALER JavaName=DEALERXX
  FIELD Name=DLRNO Start=1  Bytes=4  JavaType=CHAR                                JavaName=DealerNumber
  FIELD            Start=5  Bytes=30 JavaType=CHAR                                JavaName=DealerName
  FIELD            Start=35 Bytes=50 JavaType=CHAR                                JavaName=DealerAddress
  FIELD            Start=85 Bytes=10 JavaType=PACKEDDECIMAL TypeQualifier=S9(18) JavaName=YTDSales

SEGM DBDName=DEALERDB SegmentName=MODEL JavaName=MODELXX
  FIELD Name=MODTYPE Start=1  Bytes=2  JavaType=CHAR JavaName=ModelTypeCode
  FIELD Name=MAKE    Start=3  Bytes=10 JavaType=CHAR JavaName=CarMake
  FIELD Name=MODEL   Start=13 Bytes=10 JavaType=CHAR JavaName=CarModel
  FIELD Name=YEAR    Start=23 Bytes=4  JavaType=CHAR JavaName=CarYear
  FIELD Name=MSRP    Start=27 Bytes=5  JavaType=CHAR JavaName=Price
  FIELD              Start=32 Bytes=4  JavaType=CHAR JavaName=EPACityMilage
  FIELD              Start=36 Bytes=4  JavaType=CHAR JavaName=EPAHighwayMilage
  FIELD              Start=40 Bytes=4  JavaType=CHAR JavaName=Horsepower

SEGM DBDName=DEALERDB SegmentName=ORDER JavaName=ORDERXX
  FIELD Name=ORDNBR   Start=1   Bytes=6  JavaType=CHAR                            JavaName=OrderNumber
  FIELD               Start=7   Bytes=30 JavaType=CHAR                            JavaName=Options
  FIELD               Start=37  Bytes=5  JavaType=ZONEDDECIMAL TypeQualifier=99999 JavaName=Price
  FIELD               Start=42  Bytes=8  JavaType=CHAR                            JavaName=OrderDate
  FIELD Name=LASTNME  Start=50  Bytes=25 JavaType=CHAR                            JavaName=PurchaserLastName
  FIELD Name=FIRSTNME Start=75  Bytes=25 JavaType=CHAR                            JavaName=PurchaserFirstNme
  FIELD               Start=100 Bytes=8  JavaType=CHAR                            JavaName=SerialNo
  FIELD               Start=120 Bytes=8  JavaType=CHAR                            JavaName=DeliverDate

SEGM DBDName=DEALERDB SegmentName=SALES JavaName=SALESXX
  FIELD Name=SALDATE  Start=1  Bytes=8  JavaType=CHAR JavaName=DateSold
  FIELD Name=LASTNME  Start=9  Bytes=25 JavaType=CHAR JavaName=PurchaserLastName
  FIELD Name=FIRSTNME Start=34 Bytes=25 JavaType=CHAR JavaName=PurchasetFirstName
  FIELD               Start=59 Bytes=25 JavaType=CHAR JavaName=PurchaserAddress
  FIELD               Start=84 Bytes=10 JavaType=CHAR JavaName=SoldBy
  FIELD Name=STKVIN   Start=94 Bytes=20 JavaType=CHAR JavaName=StockVINumber

SEGM DBDName=DEALERDB SegmentName=STOCK JavaName=STOCKXX
   CobolXMI=imsjava/mdlex4/AutoStock.xmi
```

Figure 68. Second-Level Control Data Set for COBOL Copybook XMI Example

In Figure 68, under the SEGM statement for DEALER, the first FIELD statement identifies an existing field, DLRNO, by both its DBD name and its start position and length. These facts are checked for consistency against the DBD. If the field is identified correctly, then it is assigned the Java name DealerNumber, and a data type of CHAR, which is the default.

The second FIELD statement under the DEALER SEGM statement identifies an existing field by only its start position and length. If this field exists, it is assigned the Java name DealerName. This abbreviated method identifies the field, but is not quite as safe because the DLIModel utility does not check the 8-character name of the field. The default data type for DealerName is CHAR.

The third FIELD statement under the DEALER SEGM statement defines a new field—a field that is physically present in the segment, but is not described by a FIELD macro in the DBD. The FIELD statement specifies the start position and length of this field, assigns it a Java name of DealerAddress, and a data type of CHAR.

The fourth Field statement defines another new field, YTDSales, of type PACKEDDECIMAL. This data type requires a type qualifier that defines the field format. In this example, a type qualifier of `S9(18)` is supplied.

The remainder of the control statements describe information for the other segments and fields in the DBD in a similar manner, except for the STOCK segment.

The fields in the STOCK segment are described in the COBOL copybook XMI file, which is generated from a COBOL copybook file. Figure 69 shows the COBOL copybook that describes the STOCK segment fields. Before this copybook can be used as input into the DLIModel utility, it must be converted into XMI.

```
01 AutoStock.
  05 StockVINumber pic x(20).
  05 DateInfo.
    10 DateIn pic x(8).
    10 DateOut pic x(8).
  05 Color pic x(10).
  05 Price pic 9(6).
  05 Lot pic x(10).
```

Figure 69. Copybook for COBOL Copybook XMI Example

When the DLIModel utility executes, it generates the DLIModel IMS Java Report that is shown in Figure 71 on page 197, together with a matching metadata class (not shown).

When its XMI is used as input to the utility, the copybook shown in Figure 69 is equivalent to the control statements that are shown in Figure 70.

```
SEGM DBDName=DEALERDB SegmentName=STOCK JavaName=STOCKXX
FIELD Start=1 Bytes=20 JavaType=CHAR JavaName=StockVINumber
FIELD Start=21 Bytes=8 JavaType=CHAR JavaName=DateIn
FIELD Start=29 Bytes=8 JavaType=CHAR JavaName=DateOut
FIELD Start=37 Bytes=10 JavaType=CHAR JavaName=Color
FIELD Start=47 Bytes=6 JavaType=ZONEDDECIMAL TypeQualifier=9(6) JavaName=Price
FIELD Start=53 Bytes=10 JavaType=CHAR JavaName=Lot
```

Figure 70. Equivalent Control Statements for COBOL Copybook XMI Example

```
DLIModel IMS Java Report
========================
Class: DealerDatabaseView   in package com.ibm.ims.tooling  generated for PSB: autpsb4

================================================
PCB: DealershipDB
================================================
Segment: DEALERxx
Field: DealerNumber Type=CHAR Length=4        ++ Primary Key Field ++
Field: DealerName Type=CHAR Length=30            (Search Field)
Field: DealerAddress Type=CHAR Length=50
Field: YTDSales Type=PACKEDDECIMAL Type Qualifier=S9(18) Length=10
================================================
    Segment: MODELXX
    Field: ModelTypeCode Type=CHAR Length=2   ++ Primary Key Field ++
    Field: CarMake Type=CHAR Length=10           (Search Field)
    Field: CarModel Type=CHAR Length=10         (Search Field)
    Field: CarYear Type=CHAR Length=4           (Search Field)
    Field: Price Type=CHAR Length=5             (Search Field)
    Field: EPACityMilage Type=CHAR Length=4
    Field: EPAHighwayMilage Type=CHAR Length=4
    Field: Horsepower Type=CHAR Length=4
    ================================================
        Segment: ORDERXX
        Field: OrderNumber Type=CHAR Length=6           ++ Primary Key Field ++
        Field: PurchaserLastName Type=CHAR Length=25      (Search Field)
        Field: PurchaserFirstName Type=CHAR Length=25     (Search Field)
        Field: Options Type=CHAR Length=30
        Field: Price Type=ZONEDDECIMAL Type Qualifier=99999
        Field: OrderDate Type=CHAR Length=8
        Field: SerialNo Type=CHAR Length=8
        Field: DeliverDate Type=CHAR Length=8
        ================================================
        Segment: SALESXX
        Field: DateSold Type=CHAR Length=8             ++ Primary Key Field ++
        Field: PurchaserLastName Type=CHAR Length=25      (Search Field)
        Field: PurchasetFirstName Type=CHAR Length=25    (Search Field)
        Field: StockVINumber Type=CHAR Length=20         (Search Field)
        Field: PurchaserAddress Type=CHAR Length=25
        Field: SoldBy Type=CHAR Length=10
        ================================================

       Segment: STOCKXX
        Field: StockVINumber Type=CHAR Length=20      ++ Primary Key Field ++
        Field: Color Type=CHAR Length=10                (Search Field)
        Field: Price Type=ZONEDDECIMAL Type Qualifier=999999 Length=5 (Search Field)
        Field: Lot Type=CHAR Length=10                  (Search Field)
        Field: DateIn Type=CHAR Length=8
        Field: DateOut Type=CHAR Length=8
```

Figure 71. DLIModel IMS Java Report for COBOL Copybook XMI Example

In the DLIModel IMS Java Report that is shown in Figure 71, the names of segments and fields are the Java names that are supplied in the control statements and in the COBOL copybook XMI. The 8-character IMS names do not appear because the Java developer does not need to know these names.

Part 2. Service Utilities

Chapter 5. Dynamic Allocation Macro (DFSMDA)

Use the Dynamic Allocation macro (DFSMDA) to build a member (that is, one or more parameter lists) for naming data sets that can participate in dynamic allocation and deallocation.

Related Reading: Refer to *IMS Version 9: Installation Volume 1: Installation Verification* for more information about IMS.SDFSRESL.

IMS users and CICS users can dynamically allocate IMS databases. To use DFSMDA you must catalog all specified database data sets. However, you do not need to initially allocate them through control region JCL.

For Fast Path databases, if the database data sets to be allocated are registered in DBRC, the information required to dynamically allocate the data sets is obtained from DBRC. You do not need to supply DFSMDA members for them. When the dynamic allocation information is obtained from DBRC, the DISP= used to allocate the data sets is either DISP=OLD or DISP=SHARE depending on the following:

- If SHARELVL=0 or RECONS, use DISP=OLD.
- If SHARELVL=1, 2, or 3 or RECONS, use DISP=SHARE.

Related Reading: For more information about data sharing levels, see the CHANGE.DB command in *IMS Version 9: Database Recovery Control (DBRC) Guide and Reference*.

The priority of allocation information is shown in Table 18.

Table 18. Allocation Information Priorities

	DBRC	DD Statement	DFSMDA Member
DEDBs and MSDBs	1	2	3
All others	N/A	1	2

Database data sets specified in DFSMDA are allocated at different times depending on whether you are running in an IMS DB/DC, IMS Batch, CICS 2.1, or CICS 3.1 environment. The environment requirements are:

- **IMS DB/DC** database data sets are allocated either when a /START command is issued for the database or when an IMS application program is scheduled. You deallocate the data set by the /DBR command. If a database data set is specified in the JCL, it is allocated by z/OS during control region startup. You can deallocate it with the /DBR command and reallocate it with the /START command.
- **IMS Batch** database data sets are allocated near the beginning of the job step, before the batch application starts execution.

  Dynamic allocation is always attempted for all non-JCL allocated databases defined in the PSB being executed. This is performed by searching the JOBLIB/STEPLIB concatenation for DFSMDA members, unless dynamic allocation is disabled (for batch only) by the presence of the NODYNALLOC statement in your DFSVSMxx member.

  If a batch job uses a PSB with more database PCBs than are necessary for a particular job, you can avoid dynamic allocation of the unnecessary databases while still maintaining a library of DFSMDA members for all databases belonging to the PSB. You have two methods of doing this:

  - You can include the NODYNALLOC statement in your DFSVSMxx member and include DD statements for only the necessary databases in your job JCL. The library of DFSMDA members does not need to be removed from the JOBLIB/STEPLIB concatenation because the NODYNALLOC statement disables batch dynamic allocation.
  - You can maintain separate libraries of DFSMDA members, which can be included or excluded from the JOBLIB/STEPLIB concatenation as needed. DFSMDA members need not be kept in your IMSVS.SDFSRESL.

    For example, you can maintain one main library of DFSMDA members for all the databases for a PSB and maintain several subset libraries. You concatenate only the library that is appropriate for the job being run. Dynamic allocation searches the entire JOBLIB/STEPLIB concatenation for DFSMDA members, so you must remove or alter all libraries that contain undesired members.

  If the databases for which your program has update intent have logical relationships or secondary indexes, those additional databases containing the logical relationships or secondary indexes can also be allocated, whether by JCL or DFSMDA members. To cause dynamic allocation of a logically related database, change the PROCOPT to indicate update intent. To dynamically allocate a secondary index, change the PROCOPT to indicate update intent or include a PCB with PROCSEQ= for the secondary index.

  If the PCB specifies a PROCOPT that does not indicate update intent, no intent will be propagated to a logically related database or to a secondary index, and dynamic allocation will not be attempted for either of these related databases.
- **CICS** database data sets are allocated when an application program issues a schedule call for the PSB. Deallocation occurs, for example, during the processing of `STOP` and `RECOVERDB` commands issued against the database.

You can dynamically allocate online log data sets (OLDS), write ahead data sets (WADS), and system log data sets (SLDS) if they are named in the DFSMDA macro. The DFSMDA macro must be defined to permit SLDS input to IMS to restart in z/OS.

When you start an OLDS using the `/START` command, the OLDS must be defined in the DFSMDA macro, even if it is allocated in JCL.

Related Reading: Refer to *IMS Version 9: Command Reference* for descriptions of how the data sets specified in the DFSMDA macro are treated by the `/START`, `/STOP`, and `/DBR` commands.

The IMS Monitor data set can also participate in dynamic allocation and deallocation. The IMS Monitor data set is allocated when it is started with the `/TRACE ON` command and deallocated when it is stopped with the `/TRACE OFF` command. It need not be initially allocated through JCL. It must not be cataloged if residing on tape; it must be cataloged if on DASD.

Recommendation: If you use the multiple DEDB area data set facility, it is recommended that you register all data sets belonging to that area in either DBRC or DFSMDA.

The specified areas are allocated either when a `/START` command is issued for the area or when an application program attempts to use the area. The area is deallocated by `/STOP AREA`. Multiple areas can be deallocated by `/STOP ADS`.

In an XRF environment, all database and area data sets must be dynamically allocated.

The following topics provide additional information:

- "Restrictions for DFSMDA"
- "Input and Output for DFSMDA"
- "IMSDALOC Procedure" on page 204
- "Macro Statements for DFSMDA" on page 206
- "Examples of DFSMDA" on page 211

Restrictions for DFSMDA

The following restrictions apply when using the Dynamic Allocation macro:

- HALDBs are dynamically allocated and do not need the Dynamic Allocation Macro.
- If you are going to dynamically allocate a database, all DD statements referenced in the DMB for the database must be defined in the TYPE=DATASET, DDNAME= parameter. A database cannot be partially allocated by JCL and partially allocated by a dynamic allocate member.
- Because dynamic allocation cannot resolve logical relationships between DBDs, you must define a dynamic allocation member for each DBD in a logically related database. For example, a HIDAM database is composed of two logically related DBDs, the index DBD and the data area DBD. Each DBD in this example must have a dynamic allocation member with the same name as the DBD.
- The Batch Backout utility (DFSBBO00) is the only IMS utility that is supported for dynamic allocation.
- A database that is generated as a DFSMDA member cannot be given a name that is a duplicate of any label name that is generated during the assembly step of the DFSMDA job. IMS generates a label using the database name during this step, and an error occurs if that label name already exists in code invoked by DFSMDA. This restriction does not apply to data set names.
- A database that is generated as a DFSMDA member cannot be defined with a DDNAME that is identical to the DDNAME defined for another database during the same assembly step of the DFSMDA job. If more than one database must be defined with the same DDNAME (as in the case of secondary indexes), the DFSMDA job must be run separately for each required occurrence of the DDNAME.

Input and Output for DFSMDA

The input to the DFSMDA macro consists of statements as explained in "Macro Statements for DFSMDA" on page 206.

The output from the DFSMDA macro consists of text decks and linkage editor statements that are used to create load modules in IMS.SDFSRESL. Batch load modules must be created within IMS.SDFSRESL. Online load modules can be created either in IMS.SDFSRESL or in an unauthorized library.

The members for dynamic allocation can be changed simply by regenerating parameter lists with new input.

Unless it is a dynamic allocation member, no member that has the same name as a database should be link-edited into IMS.SDFSRESL.

IMSDALOC Procedure

The IMSDALOC procedure is created as a part of system definition and is placed into the IMS.PROCLIB library by stage two of IMS system definition.

This is a three step procedure for generating the list of databases and DEDB data areas that are to be dynamically allocated.

IMSDALOC assumes:

- Input is read from SYSIN.
- Each database or DEDB data set described in the input has a corresponding module placed in the dynamic allocation member data set.
- The name given to each module is the name of the database or DEDB data area described in the input.

Procedure Statement

Figure 72 shows the JCL for the IMSDALOC procedure. The parameters are described in "JCL Parameter Description" on page 205.

```
//       PROC SOUT=A,SYS2=
//ASSEM  EXEC PGM=ASMA90,
//            PARM='ALIGN,DECK,NOOBJECT,NODBCS'
//SYSLIB   DD DSN=IMS.&SYS2.SDFSMAC,DISP=SHR
//         DD DSN=SYS1.MACLIB,DISP=SHR
//SYSUT1   DD UNIT=SYSDA,SPACE=(CYL,(10,5))
//SYSPUNCH DD DSN=&OBJMOD,
//         DCB=(RECFM=FB,LRECL=80,BLKSIZE=400),
//         SPACE=(400,(100,100)),UNIT=SYSDA,
//         DISP=(NEW,PASS)
//SYSPRINT DD SYSOUT=&SOUT
//BLDMBR EXEC PGM=IEBUPDTE,PARM='NEW',
//            COND=(7,LT,ASSEM)
//SYSPRINT DD DUMMY
//SYSUT2   DD DSN=&TEMPPDS,UNIT=SYSDA,
//         DISP=(NEW,PASS,DELETE),
//         SPACE=(80,(1000,500,10)),
//         DCB=(RECFM=F,BLKSIZE=80)
//SYSIN    DD DSN=*.ASSEM.SYSPUNCH,
//         DISP=(OLD,DELETE,DELETE)
//LNKEDT EXEC PGM=IEWL,PARM='LIST,XREF,LET',
//            COND=((7,LT,ASSEM),(3,LT,BLDMBR))
//SYSUT1   DD UNIT=SYSDA,SPACE=(1024,(100,50))
//SYSLIB   DD DUMMY
//SYSPRINT DD SYSOUT=&SOUT
//SYSLMOD  DD DSN=IMS.&SYS2.SDFSRESL,DISP=SHR
//OBJMOD   DD DSN=&TEMPPDS,DISP=(OLD,DELETE,DELETE)
//SYSLIN   DD DSN=&TEMPPDS(LNKCTL),
//         DISP=(OLD,DELETE,DELETE),
//         VOL=REF=*.OBJMOD
```

Figure 72. JCL for the IMSDALOC Procedure

Recommendation: The SPACE parameter should be increased to accommodate large volumes of TYPE=DATABASE statements.

JCL Parameter Description

SOUT=
Specifies the class assigned to SYSOUT DD statements.

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS2='IMSA.'.

Step ASSEM

Step ASSEM is the assembly step.

Related Reading: Refer to *HLASM MVS & VM Programmer's Guide* for information on assembly steps.

DD Statements

SYSIN DD
Defines the input data sets to step C. These DD statements must be provided when invoking the procedure.

Step BLDMBR

Related Reading: Refer to the IEBUPDTE utility in *z/OS DFSMSdfp Utilities* for information on this step.

Step LNKEDT

Step LNKEDT is the link-edit step.

Related Reading: Refer to *z/OS MVS Program Management: User's Guide and Reference* for information on linkage-editors.

DD Statements

SYSLMOD DD
Defines an output partitioned data set for the linkage editor.

For batch execution, the data set must be concatenated with IMS.SDFSRESL, and can be either an authorized library, or an unauthorized data set. To use an authorized library, you must include the DFSRESLB DD statement in the batch execution procedure.

For online execution, or in a DBCTL environment, the data set can be an authorized data set included in the IMS.SDFSRESL concatenation, or an unauthorized data set. To use an unauthorized data set, you must define it to the control region by adding an IMSDALIB DD statement to the online or DBCTL execution procedure. This unauthorized data set will then take precedence over the IMS.SDFSRESL concatenation when seeking a dynamic allocation parameter list or member.

Invoking the Procedure

The dynamic allocation macro statements are supplied as input to the IMSDALOC procedure and executed as a z/OS job.

Requirement: A JOB statement (defined by the using installation), an EXEC statement, and DD statements that define the input and output data sets are required.

The following JCL statement invokes the IMSDALOC procedure.

```
//DALOC    JOB
//*
//STEP    EXEC IMSDALOC
//*
//SYSIN     DD  *
   DFSMDA TYPE=
   END
/*
```

EXEC
Should be in this form:

```
//STEP    EXEC IMSDALOC
```

SYSIN DD
Defines the input data set containing the DFSMDA macro statements.

Macro Statements for DFSMDA

The DFSMDA macro is coded as a z/OS macro. The statement label is optional, the macro "DFSMDA" is coded after one or more blanks, and additional parameters are separated by blanks. z/OS continuation rules apply.

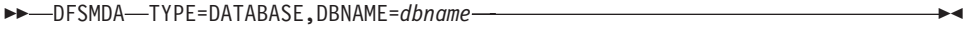
The DFSMDA macro has several statement types (as indicated by the TYPE= parameter), each of which uses different additional parameters. Code the statements types as follows:

1. One TYPE=INITIAL statement to start the parameter list build
2. As many TYPE=DATABASE, TYPE=DATASET, and TYPE=FPDEDB statements as necessary
3. One TYPE=DFSDCMON if the IMS Monitor data set is to be included
4. One TYPE=FINAL to end the list

The maximum number of TYPE=DATABASE statements allowed is 250. Explanations of all the DFSMDA statement types follow:

TYPE=INITIAL Statement
This statement indicates the start of a parameter list build and is required. No other parameters are valid on a TYPE=INITIAL statement. The format of this statement is:

TYPE=DATABASE Statement
This statement specifies the start of the definition for a database to participate in dynamic allocation and deallocation: one or more TYPE=DATASET statements should follow. (Do not use this statement for a DEDB area.) The format of the statement is:

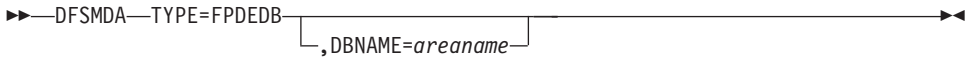


DBNAME=
Specifies the DBD name of a database whose data sets are to be dynamically allocated. This name is used as a member name in

IMS.SDFSRESL to identify this database parameter list. Care should be taken to ensure that this name does not conflict with already existing members in IMS.SDFSRESL. This includes, but is not limited to, IMS modules and user-supplied exit routines.

TYPE=FPDEDB Statement

This statement defines an area within a data entry database (DEDB). One TYPE=FPDEDB statement is required for each area to be specified. The format of this statement is:



DBNAME=

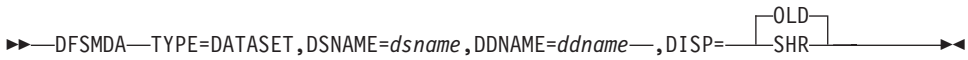
Specifies the DBD name of the DEDB in which the specified area resides. This parameter is optional, and is used for documentation purposes only. For DEDB areas, the IMS.SDFSRESL parameter list is not named with the database name, but rather with the area's ddname.

TYPE=DATASET Statement

This statement defines either a data set within the database specified in the previous TYPE=DATABASE statement or a DEDB area. One complete TYPE=DATASET is used for each data set or area data set defined. Every data set within a database to be dynamically allocated and deallocated must be named in a TYPE=DATASET statement. When defining DEDB areas, a TYPE=FPDEDB statement must precede each TYPE=DATASET statement.

If the data set within a database identifies a secondary index data set shared with another database, the DFSMDA members for the two databases must be generated in separate assemblies.

The format of this statement is:



DSNAME=

Specifies the name of the data set. The name can be any combination of simple and compound names valid in JCL, except the name cannot contain special characters.

DDNAME=

Specifies the name of the DD statement defining this data set. This name is the same as that used in the DATASET or AREA statement of the DBDGEN.

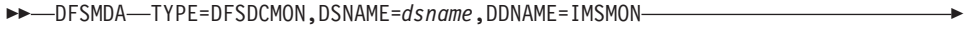
For multiple ADSs, this name is the same as the ADDN name registered in the ADS RECON data set.

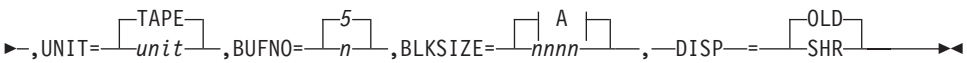
DISP=

Specifies the disposition of this data set when allocated. The default is OLD.

TYPE=DFSDCMON Statement

This statement defines the dynamic allocation parameter list for the IMS Monitor data set. The format of this statement is:





A:

DSNAME=
Specifies the name of the data set, which must not be cataloged if the unit defines a TAPE device. However, if UNIT=DASD is specified, then the data set must be cataloged and available. The name can be any combination of simple and compound names valid in JCL, but must not contain special characters.

DDNAME=IMSMON
Is the required value for DDNAME.

UNIT=
Specifies the unit for the DC Monitor data set. If the data set resides on a direct access device, UNIT=DASD must be specified and the data set must be cataloged. Otherwise, the value of UNIT= can be the name of any tape device valid to the installation. The default is UNIT=TAPE.

BUFNO=
Specifies the number of buffers for the IMS Monitor data set. Valid numbers range from 2 to a

- a maximum of 99 for DFP
- 255 for DFSMS

The default is 4.

BLKSIZE=
Specifies the block size for the IMS Monitor data set. For a tape device (UNIT≠DASD), the default is 32K. If UNIT=DASD, the default is 28,332.

DISP=
Specifies the disposition for the IMS Monitor data set for a UNIT=DASD data set definition. Valid values are OLD and SHR. OLD is the default if this parameter is not supplied. A warning message is issued if any other value is supplied, and a DISP=OLD value overrides the value specified.

TYPE=RECON Statement

This statement defines the dynamic allocation parameter list for database recovery control (DBRC).

The format of this statement is:

DSNAME=
Specifies the name of the data set. The name can be any combination of simple and compound names valid in JCL, except that it cannot contain special characters.

DDNAME=
Specifies the name of the DD statement defining this data set. This name must be RECON1, RECON2, or RECON3.

WAIT=
If YES is specified on any of the TYPE=RECON statements (RECON1, RECON2, RECON3), a wait is issued for any of the RECONs found to be offline during DBRC initialization. WAIT=NO is the default. Omitting the WAIT= parameter or specifying WAIT=NO causes dynamic allocation to fail in the event that a RECON data set is offline during DBRC initialization.

TYPE=OLDS Statement

This statement defines the dynamic allocation parameter list for the online log data set (OLDS).

There must be as many DFSMDA macros as there are OLDS.

Requirement: If you use dual logging, DFSMDA member names are required for both the primary and secondary OLDS.

The format of this statement is:

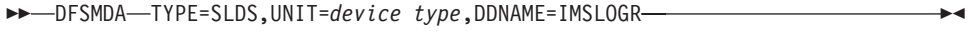
DSNAME=
Specifies the name of the data set. The name can be any combination of simple and compound names valid in JCL, except that it cannot contain special characters.

DDNAME=
Specifies the OLDSs to be allocated. If the OLDSs are dual, there must be a pair of macros, one with the ddname of the primary OLDS and the other with the ddname of the secondary OLDS (for example, DFSOLP01 and DFSOLS01). The data set must be cataloged. Substitute P for x when declaring a primary data set. Substitute S for x when declaring a secondary data set. Values from 00 through 99 can be specified for nn.

TYPE=SLDS Statement

This statement defines the dynamic allocation parameter list for the SLDS. SLDSs are dynamically allocated when required as input for restart. A single DFSMDA member with name IMSLOGR must be created to specify the UNIT information required for allocation. All SLDSs to be used as input to restart must reside on the same device type.

The format of this statement is:



UNIT=
Specifies the device required for allocation. All SLDSs used as input for restart must reside on the same device type. This applies to both the primary and secondary data sets when dual logging is used. The device type can be tape or DASD.

DDNAME=IMSLOGR
Is the required value for DDNAME.

TYPE=TRACE Statement

This statement defines the dynamic allocation parameter for external trace data

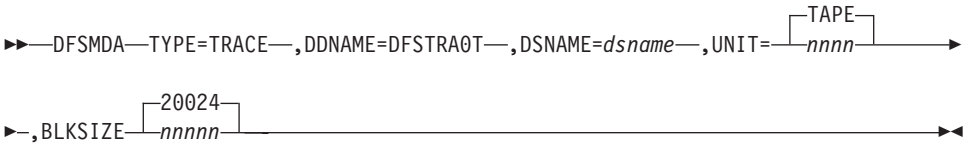
sets. External trace data can be written to disk storage or to a tape unit. The statement differs with the type of storage chosen.

The format of the statement for disk allocation is:

DDNAME
Specifies the ddname of the data set located on the disk. **n** specifies the number of the data set, and must be either 1 or 2. Each data set must be cataloged. Use two data sets to ensure that trace data is available at EOV.

DSNAME
Specifies the data set name. The name can be any combination of alphanumeric characters that is valid for IMS, except for special characters such as @, $, or #. DSNAME can be up to 44 bytes long.

The format for data set allocation to tape is:



DDNAME
Specifies the ddname of the data set located on the tape. DFSTRA0T is the required ddname if you allocate the external trace data set to a tape.

DSNAME
Specifies the data set name. DSNAME must not be cataloged. The name and can be any combination of alphanumeric characters that is valid for IMS, except for special characters such as @, $, or #. The name you specify can be up to 44 bytes long.

UNIT
Specifies the unit for the external trace data set. The unit must be a tape device, but can be any name valid to the installation. The default value is TAPE.

BLKSIZE
Is the block size of the external trace data set. The minimum value is 4008. Any other value chosen must be a multiple of 4004 (the LRECL) plus 4. The default is 16384.

Recommendation: IBM now recommends 20024. The recommended BLKSIZE for current DASD is 20024 because it is 1/2 track.

Future DASD might change the track size, and older DASD might have different track sizes.

TYPE=WADS Statement
This statement defines the dynamic allocation parameter list for the write ahead data set (WADS).

There must be as many DFSMDA macros as there are WADS data sets.

Requirement: If dual logging is used, DFSMDA member names are required for both the primary and secondary WADS.

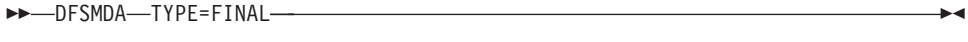
The DFSMDA member name must be the same as the ddname of the WADS that it defines.

The format of this statement is:

DSNAME=
Specifies the name of the data set. The name can be any combination of simple and compound names valid in JCL, except that it cannot contain special characters. The data set must be catalogued.

DDNAME=
Specifies the WADS to be allocated. Values 0 through 9 can be specified for n. When dual logging for the WADS is requested using the WADS=D execution time parameter, there must be at least two WADS provided.

TYPE=FINAL Statement
This statement indicates the end of a parameter list build and is required. No other parameters are valid on a TYPE=FINAL statement. The format of this statement is:



Examples of DFSMDA

The examples in this section contain the following comment line above the SYSIN statement, for reference only, to aid in column alignment.

```
//* +----1----+----2----+----3----+----4----+----5----+----6----+----7---
```

Example 1

Example 1 shows the JCL and macro statements to specify three databases and the IMS Monitor data set to participate in dynamic allocation and deallocation.

```
//DALOC    JOB
//*
//STEP    EXEC IMSDALOC
//* +----1----+----2----+----3----+----4----+----5----+----6----+----7---
//SYSIN     DD  *
   DFSMDA TYPE=INITIAL
   DFSMDA TYPE=DATABASE,DBNAME=DI41M101
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.M1I3I1,DDNAME=M1I3I1
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.M1I3O1,DDNAME=M1I3O1
   DFSMDA TYPE=DATABASE,DBNAME=DX41SK03
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.DB5H111,DDNAME=DXSK0301,           X
               DISP=SHR
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.DB5H222,DDNAME=DXSK0302,           X
               DISP=SHR
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.DB5H333,DDNAME=DHSK0301,           X
               DISP=SHR
   DFSMDA TYPE=DATABASE,DBNAME=DH41SK03
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.DB4D111,DDNAME=DDSK0101,           X
               DISP=SHR
   DFSMDA TYPE=DATASET,DSNAME=IMSQA.DB4D222,DDNAME=DDSK0102,           X
               DISP=SHR
   DFSMDA TYPE=DFSDCMON,DDNAME=IMSMON,DSNAME=I115T237.IMSMON
   DFSMDA TYPE=FINAL
   END
/*
```

Example 2

Example 2 shows the JCL and macro statements to specify three DEDB areas to participate in dynamic allocation and deallocation.

```
//DALOC    JOB
//*
//STEP    EXEC IMSDALOC
//* +----1----+----2----+----3----+----4----+----5----+----6----+----7---
//SYSIN     DD  *
   DFSMDA TYPE=INITIAL
   DFSMDA TYPE=FPDEDB,DD41SK02
   DFSMDA TYPE=DATASET,DSNAME=DB9AREA0,DDNAME=DB9AREA0
   DFSMDA TYPE=FPDEDB
   DFSMDA TYPE=DATASET,DSNAME=DB22AR0,DDNAME=DB22AR0,                  X
               DISP=SHR
   DFSMDA TYPE=FPDEDB,DEDBJN22
   DFSMDA TYPE=DATASET,DSNAME=DB22AR1,DDNAME=DB22AR1,                  X
               DISP=OLD
   DFSMDA TYPE=FINAL
   END
/*
```

Example 3

In z/OS, SLDSs are dynamically allocated when required as input for restart. Example 3 shows the JCL and macro statements for SLDS to participate in dynamic allocation and reallocation.

```
//ASSMBLY EXEC IMSDALOC
//*
//SYSLIB    DD  DSN=RNC.SDFSMAC,DISP=SHR
//          DD  DSN=I13OTS13.SDFSMAC,DISP=SHR
//          DD  DSN=IMS.&SYS2.SDFSMAC,DISP=SHR
//* +----1----+----2----+----3----+----4----+----5----+----6----+----7---
//SYSIN     DD  *
   DFSMDA TYPE=INITIAL
   DFSMDA TYPE=SLDS,UNIT=SYSDA,DDNAME=IMSLOGR
   DFSMDA TYPE=FINAL
   END
/*
//LNKEDT.SYSLMOD DD DSNAME=IMSQA.TNUC2,DISP=SHR,
//             UNIT=SYSDA,VOL=SER=USER01
```

Example 4

Example 4 shows the statements required to build allocation members for RECON data sets and to trace data sets on DASD.

```
//DYNALL   JOB
//*
//STEP    EXEC IMSDALOC
//SYSIN     DD  *
   DFSMDA TYPE=INITIAL
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON01,DDNAME=RECON1,WAIT=YES
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON02,DDNAME=RECON2,WAIT=YES
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON03,DDNAME=RECON3,WAIT=YES
   DFSMDA TYPE=TRACE,DDNAME=DFSTRA01,DSN=IMS41.DFSTRA01
   DFSMDA TYPE=TRACE,DDNAME=DFSTRA02,DSN=IMS41.DFSTRA02
   DFSMDA TYPE=FINAL
   END
/*
```

Example 5

Example 5 shows the statements required to build allocation members for RECON data sets and to trace data sets on tape.

```
//DYNALL   JOB
//*
//STEP    EXEC IMSDALOC
//SYSIN     DD  *
   DFSMDA TYPE=INITIAL
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON01,DDNAME=RECON1,WAIT=YES
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON02,DDNAME=RECON2,WAIT=YES
   DFSMDA TYPE=RECON,DSNAME=IMSV41.RECON03,DDNAME=RECON3,WAIT=YES
   DFSMDA TYPE=TRACE,DDNAME=DFSTRA0T,DSNAME=TAPEDS1,UNIT=TAPE,BLKSIZE=20024
   DFSMDA TYPE=FINAL
   END
/*
```

Examples

Chapter 6. Security Maintenance Utility (DFSISMP0)

IMS does not support Security Maintenance utility (SMU) or application group name (AGN) security after Version 9. For this reason, security functions that formerly required the use of SMU can now be performed using Resource Access Control Facility (RACF®), resource access security (RAS), and exit routines. For more information, see *IMS Version 9: Administration Guide: System*.

For security beyond that provided by default terminal security, you can use the various security options specified with the SMU. The utility is executed offline after completion of Stage 2 processing for system definition. Its output is a set of secured-resource tables placed on the IMS.MATRIX data set. The tables are loaded at system initialization time, and, for certain options, work with exit routines or the RACF program product during online execution to provide resource protection.

The Security Maintenance utility provides five security options:

LTERM security
: Defines the commands and transactions that can be used from a given physical or logical terminal

Password security
: Limits the use of a specified IMS resource to someone who supplies the correct password

Resource access security
: Limits the set of IMS resources which can be used by dependent regions that are authorized to access a specific Application Group

Transaction command security
: Lets an application program issue a subset of IMS operator commands (using the DL/I CMD call)

Sign-on verification security
: Identifies a particular user to IMS to determine if each transaction entered by that user is authorized to the user id currently logged on

z/OS users can also use the RACF program product if desired. See “Sign-on Verification Security” on page 219.

Although IMS system definition creates most resident control blocks for the IMS control program, it supplies only basic terminal security which prohibits the entry of certain commands from any terminal other than the master terminal. If no security options are specified by system definition, the generated IMS system protects the following commands from non-master terminal use:

/ASSIGN	/DEQUEUE	/MSASSIGN	/RMxxxxxx[1]
/CHANGE	/DISPLAY	/MSVERIFY	/RSTART
/CHECKPOINT	/ERESTART	/NRESTART	/SMCOPY
/CLSDST	/IDLE	/OPNDST	/SSR
/COMPT	/LOOPTEST	/PSTOP	/START
/DBDUMP	/MODIFY	/PURGE	/STOP
/DBRECOVERY	/MONITOR	/QUIESCE	/TRACE
/DELETE			

Note:

1. RMLIST is not protected from non-master terminal use.

The basic level of security is called default terminal security. It exists whether or not the Security Maintenance utility is used to implement the added security features of IMS.

The following topics provide additional information:

Input and Output Flow for DFSISMP0

Figure 73 on page 217 shows the flow of input to and output from the Security Maintenance utility. When you run the Security Maintenance utility, it receives input from the IMS.SDFSRESL data set, the IMS.MODBLKS data set, and from input statements. The utility outputs a security listing and a set of secured resource tables to the IMS.MATRIX data set. The output includes the following secured resource tables:

- Communication password table (CPT)
- Communication password matrix (CPM)
- Password offset list
- Communication matrix (CTM)
- Terminal offset list (CTL)
- Transaction matrix
- Transaction offset list
- Sign-on offset list
- Application group names table

Refer to Figure 73 on page 217 as you read the remaining sections of this chapter.

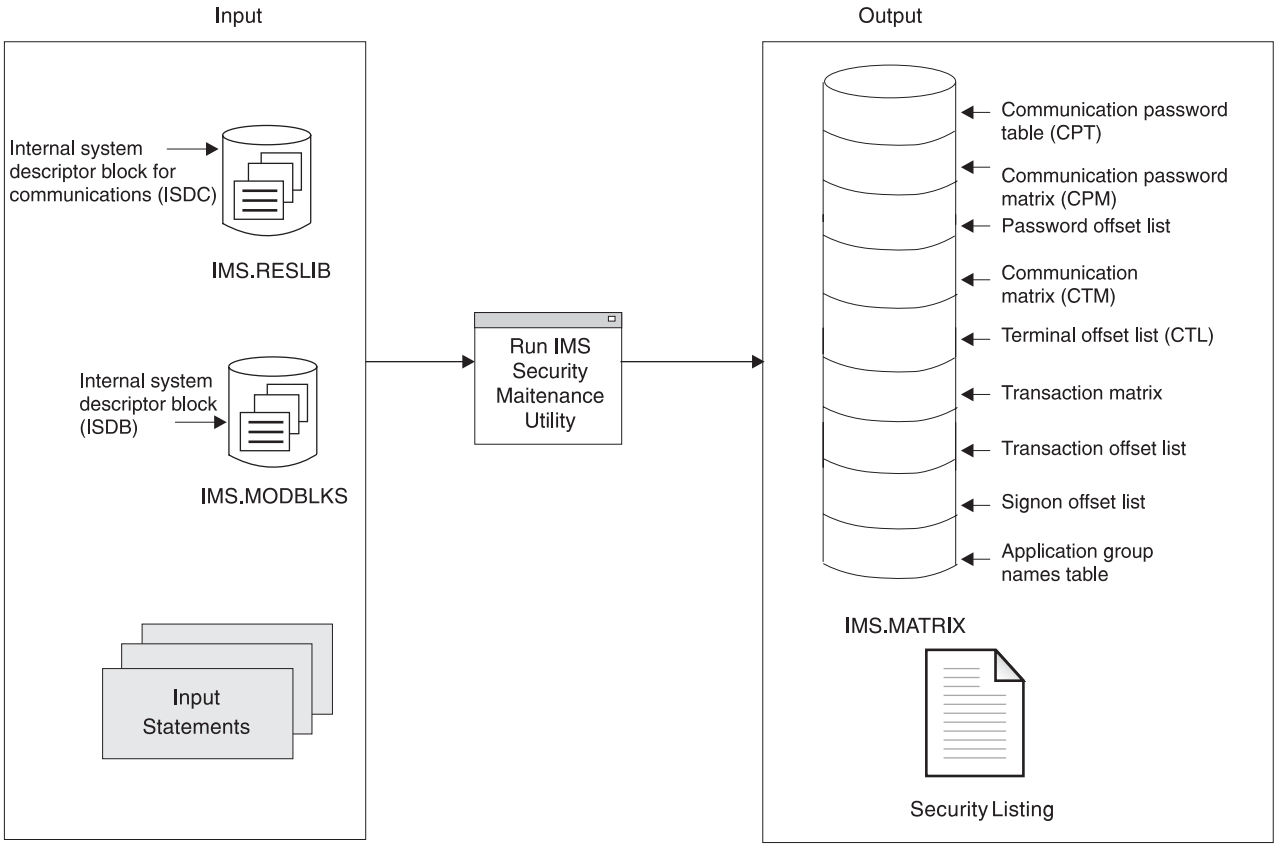


Figure 73. Security Maintenance Utility Data Set Requirements

Restrictions for DFSISMP0

The following restrictions apply to the Security Maintenance utility.

- If you do not use RACF, sign-on verification and IMS application group name security require user exit routines. IMS does not supply exit code except for sample user exit routines.
- The Security Maintenance utility does not provide LTERM, password, resource, transaction command, or sign-on verification security for terminals defined with the Extended Terminal Option (ETO) or for LU 6.2 devices. If your system uses ETO or LU 6.2 terminals, use RACF or an equivalent security product to provide terminal security functions.
- SMU cannot be used for transaction command security for DL/I ICMD or RCMD calls.

Related Reading: For more information about security for ETO and LU 6.2 terminals, see *IMS Version 9: Administration Guide: System*.

Security Options for DFSISMP0

This section provides a brief explanation of each of the five security options for the Security Maintenance utility.

LTERM Security

This security option allows you to define a set of commands and transactions that are authorized for use by specified logical terminals. Using the Security Maintenance utility, you can define a maximum of 65 535 different patterns for these sets of commands and transactions. Aa pattern is a unique set of commands issued by one or more terminals. For example, two terminals issuing the same set of commands constitutes one pattern and two terminals issuing different sets of commands constitutes two patterns.

For multiple IMS systems, you can also specify a set of authorized transactions that can be passed to an IMS system using a logical data link. Terminal security requires no external user exit routines.

Password Security

This option specifies the use of a password with terminal input. Resources cannot be used unless a correct password is supplied. Password security can be used for:

- Transactions
- Commands

When an operator enters the /LOCK or /UNLOCK command to control the use of online resources, the use of several keywords can be protected by requiring a password. The resources that can be protected are:

- PTERM
- LTERM
- Application programs
- Databases

Transaction Command Security

You must use a security option to authorize an online application program to issue IMS commands using the DL/I CMD and GCMD calls. You make the authorization by associating the transaction that invokes the program with a list of commands that the program is designed to use. In the case of an automated operator program, you need to specify all the commands the program is designed to use.

Related Reading: For more information on the list of commands that programs can issue, see *IMS Version 9: Command Reference*.

Transaction command security requires no user exit routines.

IMS Application Group Name Security

Application group name (AGN) security prevents an IMS resource from being used by a dependent message region unless that resource has been authorized for use by the dependent region. It also prevents an unauthorized dependent message region from starting.

In the SECURITY macro during system definition, you specify whether resource access security is included and whether RACF or a user exit routine is used for the authorization validation.

Using DFSISMP0, you define a list of IMS resources and assign a unique AGN to the list. Security Maintenance places this AGN in a table the IMS system

recognizes. IMS prevents the use of resources by a dependent message region unless that resource is listed in the AGN table.

You must either provide a user exit routine or use RACF to authorize the start of a dependent message region.

Sign-on Verification Security

You can prevent an unauthorized user from accessing the IMS system from a local or remote terminal by defining a list of statically defined terminals that require sign-on verification. Sign-on verification security identifies a user to IMS as being present from the /SIGN ON command entry until a /SIGN OFF command is entered.

Using the Security Maintenance utility, you can define a maximum of 65 535 terminals to require sign-on verification. Two alternative ways to specify the sign-on verification requirement include:

- On the OPTIONS= parameter of the TYPE and TERMINAL IMS system definition macros
- With the SIGNON= parameter in the DFSDCxxx PROCLIB member

These alternatives do not have the 65 535 maximum.

You can also restrict those authorized users (user IDs) to specific transactions. You do this by specifying, along with sign-on verification security, transaction authorization. As each transaction is entered from a terminal, either RACF or a user exit routine, or both, validate it for the user ID signed on. If the terminal from which the transaction is entered does not require sign-on verification, the transaction code is still checked by RACF or by the user exit routine.

IMS Application Resource Access Security

Application resource access security permits online programs to determine the access authority of the user requesting the transaction. This level of security is available by issuing an Authorization (AUTH) call in conjunction with RACF.

You define the resources whose access will be restricted within the application program to RACF. These resources include terminals, spool readers, and data sets.

You can use the normal IMS security exit routines (such as the /SIGN ON exit routine and the Transaction Authorization exit routine) for additional control of the authorization process.

Related Reading: For more information on the AUTH call, see *IMS Version 9: Application Programming: Database Manager*.

SECURITY Procedure

The SECURITY procedure is created as a part of system definition and is placed into the IMS.PROCLIB procedure library by stage two of IMS system definition.

To run the security maintenance program, you must have previously defined an IMS control program using the value ALL, ON-LINE, NUCLEUS, CTLBLKS, or MODBLKS as the second sub-list entry of the SYSTEM parameter of the IMSCTRL macro instruction. Two of the modules created during Stage 2 of IMS system

definition are a directory of communication resources and a directory of database resources of the defined system. They are placed in the IMS.SDFSRESL and IMS.MODBLKS data sets, respectively.

Requirement: These directories and the security maintenance control statements are the required input for the Security Maintenance utility.

The security maintenance program runs as a three-step job. The first step (Step S) accepts the input control and data statements and checks them against the IMS system being maintained to ensure correct format and validity. If there are no errors in the first step, the second step (Step C), an operating system assembly, is performed. The third step (Step L) is a link-edit which takes the assembly output from Step C and creates the following:

- Password table
- Password matrix
- Password matrix relative pointer lists
- Terminal matrix
- Terminal matrix relative pointer lists
- Transaction command matrix
- Transaction command matrix relative pointer list
- Sign-on relative terminal list
- Application Group Name table

Depending on the input presented, there are a variable number of output load modules created. The maximum size of any generated matrix is:

```
M=(IxR)/8
```

where:

I Is the number of secured resources as shown in Table 19 for each matrix:

Table 19. Matrix Secured Resources for Variable I

Matrix	Secured Resource
Password	Passwords
Terminal	Logical terminals and linknames
Transaction Command	Transactions

Restriction: To produce a valid terminal matrix, the number of LTERMs, transactions, databases, and programs specified at system definition cannot exceed 65535, otherwise a DFS1913E will be received with a return code of 8.

R Is the number of secured resources as shown in Table 20 for each matrix. If more than one secured resource is secured to the same set of securing resources, only one secured resource is counted in order to calculate the size of the matrix. For example, if one or more transactions or commands can be entered by the identical sub-lists of LTERMs, these transactions or commands are counted as a single secured resource.

Table 20. Matrix Secured Resources for Variable R

Matrix	Secured Resource
Password	Commands, databases, LTERMs, programs, PTERMs, transactions

Table 20. Matrix Secured Resources for Variable R (continued)

Matrix	Secured Resource
Terminal	Transactions, commands
Transaction Command	Commands

M Is the total virtual storage requirement in bytes.

Procedure Statement

Figure 74 shows the JCL for the SECURITY procedure. The parameters are described in "JCL Parameter Description."

```
//       PROC OPTN=UPDATE,IMS=',0',SOUT=A,SYS2=,
//            RGN=0M
//S      EXEC PGM=DFSISMP0,PARM='&OPTN.&IMS.'
//STEPLIB  DD DSN=IMS.&SYS2.MODBLKS,DISP=SHR
//         DD DSN=IMS.&SYS2.SDFSRESL,DISP=SHR
//SYSPRINT DD SYSOUT=&SOUT,
//         DCB=(RECFM=VBA,BLKSIZE=129,LRECL=125)
//SYSPUNCH DD UNIT=SYSDA,SPACE=(CYL,(2,2)),
//         DCB=(RECFM=FB,LRECL=80,BLKSIZE=400),
//         DISP=(NEW,PASS)
//SYSLIN   DD  UNIT=SYSDA,SPACE=(TRK,(1,1)),
//         DCB=(RECFM=F,BLKSIZE=80),
//         DISP=(NEW,PASS)
//SYSUT1   DD UNIT=SYSDA,DCB=(BLKSIZE=500,RECFM=FB),
//         SPACE=(CYL,(2,2))
//SYSUT2   DD UNIT=(SYSDA,SEP=SYSUT1),DCB=*.S.SYSUT1,
//         SPACE=(CYL,(2,2))
//SYSIN    DD DSN=NO.SYSIN.DD.ASTERISK
//C      EXEC PGM=ASMA90,
//            PARM='OBJECT,NODECK,NODBCS',
//            COND=(12,LT,S),REGION=&RGN
//SYSLIB   DD DSN=SYS1.MACLIB,DISP=SHR
//SYSPRINT DD SYSOUT=&SOUT,DCB=BLKSIZE=1089
//SYSLIN   DD UNIT=(SYSDA,SEP=SYSPRINT),DISP=(,PASS),
//         SPACE=(CYL,(2,2)),
//         DCB=*.S.SYSPUNCH
//SYSUT1   DD UNIT=SYSDA,SPACE=(CYL,(10,5))
//SYSIN    DD DSN=*.S.SYSPUNCH,DISP=(OLD,DELETE)
//L     EXEC PGM=IEWL,PARM=(LIST,NE,OL),
//            REGION=&RGN,COND=(4,LT,S)
//SYSPRINT DD SYSOUT=&SOUT,
//         DCB=(RECFM=FBA,LRECL=121,BLKSIZE=605)
//SYSLMOD  DD DSN=IMS.&SYS2.MATRIX,DISP=SHR
//INPUT    DD DSN=*.C.SYSLIN,DISP=(OLD,DELETE)
//SYSUT1   DD UNIT=(SYSDA,SEP=INPUT),SPACE=(CYL,(5,1))
//SYSLIN   DD DSN=*.S.SYSLIN,DISP=(OLD,DELETE)
```

Figure 74. JCL for the SECURITY Procedure

JCL Parameter Description

SOUT=
Specifies the class assigned to SYSOUT DD statements.

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as "Optional Replicate" in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS2='IMSA.'.

RGN=
Specifies the region size for this procedure. In Figure 74 on page 221 the region size is specified as 2048 KB.

Step S EXEC Statement

The EXEC statement specifies the program name (PGM=DFSISMP0), and must contain a PARM keyword value in the form:

```
//STEP    EXEC PGM=DFSISMP0,PARM='option,number'
```

option
Is one of the following:

LIST Validity check and list new security tables.

UPDATE Validity check, list, and update security tables in MATRIX.

number
Is any valid alphanumeric that is the last character of the IMS nucleus member name to be maintained.

The default value for PARM= is 'UPDATE,0'.

DD Statements

STEPLIB
Defines the partitioned data sets named IMS.SDFSRESL and IMS.MODBLKS. Contains the members DFSVNUCn, DFSISMP0, DFSISDBn, and DFSISDCn.

SYSPRINT DD
Defines a sequential message data set. The data set can be written to system output devices, magnetic tape, or direct-access volumes. The following DCB parameters must be specified:

```
RECFM=VBA
LRECL=125
BLKSIZE=129 or greater
```

SYSPUNCH DD
Defines a sequential output data set that contains assembler statements produced by this step. The data set can be passed to Step C. The following DCB parameters must be specified:

```
RECFM=F or FB
LRECL=80
BLKSIZE=80 or multiple of 80
```

SYSLIN DD
Defines a sequential output data set that contains linkage editor control statements produced by Step S. The data set can be passed to Step L. The following DCB parameters must be specified:

```
RECFM=F or FB
LRECL=80
BLKSIZE=80 or multiple of 80
```

SYSUT1 DD
Defines a sequential work data set used only during this step. The following DCB parameters must be specified:

```
RECFM=F or FB
BLKSIZE=100 or multiple of 100
```

SYSUT2 DD
Defines a sequential work data set used only during this step. The following DCB parameters must be specified:

```
RECFM=F or FB
BLKSIZE=100 or multiple of 100
```

SYSIN DD
Defines a sequential data set or a member of a partitioned data set that contains security maintenance input statements. The following DCB parameters must be specified:

```
RECFM=F or FB
BLKSIZE=80 or multiple of 80
```

Step C

Step C is the assembly step.

Related Reading: Refer to *HLASM MVS & VM Programmer's Guide* for information on assembly steps.

DD Statements

SYSIN DD
Defines the passed sequential input data set created in steps using ddname SYSPUNCH.

Step L

Step L is the link-edit step.

Related Reading: Refer to *z/OS MVS Program Management: User's Guide and Reference* for information on linkage-editors.

DD Statements

SYSLMOD DD
Defines an output partitioned data set, IMS.MATRIX, for the linkage editor.

INPUT DD
Defines the passed sequential temporary data set created using ddname SYSGO in Step C.

Invoking the Procedure

The following JCL is used to invoke the SECURITY procedure:

```
//         JOB
//*
//STEP    EXEC PROC=DFSISMP0
//*
//SYSIN     DD  *
   ⋮
   END
/*
```

EXEC
Should be in this form:

```
//STEP    EXEC PROC=DFSISMP0
```

SYSIN DD
Defines a sequential data set or a member of a partitioned data set that contains security maintenance input statements. The following DCB parameters must be specified:

```
RECFM=F or FB
BLKSIZE=80 or multiple of 80
```

Utility Control Statements for DFSISMP0

Input to the Security Maintenance utility consists of control and data statements. A control statement indicates to the utility that security is being established for the system resource named by that statement. Control statements are identified by closed and open parentheses characters in combination,)(, in character positions 1 and 2 of the input statement, followed by a blank in character position 3. A control statement remains in effect until another control statement or end of input data is encountered.

Data statements describe the security to be established for the system resource defined by the preceding control statement. All data statements following a control statement are associated with that control statement. Data statements are identified by a blank in character position 1 of the input statement. Each statement, control or data, has only one parameter, separated from the operation by a blank. Any number of valid data statements can be used in conjunction with a given control statement.

Input data must be entered in columns 1 through 71 of the input statements; columns 72 through 80 are ignored.

Comments can be included following the parameter specifications on control and data statements. Comment-only statements can be specified by an asterisk in column 1.

Use Table 21 to determine which input statements can be used as control statements, data statements, or both.

Table 21. Security Maintenance Utility Input Statements

Input Statement	Control Statement	Data Statement
AGN	X	N/A
SIGN	X	N/A
AGLTERM	N/A	X
AGPSB	N/A	X
AGTRAN	N/A	X
STERM	N/A	X
COMMAND	X	X
CTRANS	X	X
DATABASE	X	X
PASSWORD	X	X
PROGRAM	X	X
PTERM	X	X
TCOMMAND	X	X
TERMINAL	X	X
TRANSACT	X	X

The operands which can be used with the statements listed in Table 21 are:

Password
A password is any combination of 1 to 8 alphanumeric characters. The

longest password encountered on a PASSWORD statement in the input stream governs the maximum length of input passwords that will be accepted by your IMS system.

To define additional passwords, a PASSWORD control statement is used with no following data statements:

```
)( PASSWORD ABCD
)( PASSWORD EFGH
```

Logical terminal name or linkname
A valid logical terminal name or linkname is 1 to 8 characters in length. It must be defined in the IMS system being maintained or it is invalid. Any invalid terminal names or linknames are rejected by Security Maintenance.

Transaction code
A valid transaction code is 1 to 8 characters in length. It must be defined in the IMS system being maintained. If it is not defined, it is treated as invalid by the utility.

Command language verb
Valid command language verbs are obtained from the Stage 2 output of IMS system definition.

Related Reading: Refer to *IMS Version 9: Installation Volume 2: System Definition and Tailoring* for more information on the command language verbs used in Stage 2.

The command verb, less leading slash, can be abbreviated to the first three characters.

Name Name is a valid database name, program name, VTAM® node name, Application Group name, or BTAM physical terminal number as obtained from the output of IMS system definition.

Only the first three characters of the operation code are required to identify control or data statements.

Physical terminal numbers are found in the Stage 1 listing and in the assembly of DFSISDB0 in Stage 2 of the IMS system definition.

The following list shows the valid combinations of control statements and data statements that Security Maintenance accepts:

Control Statements	Valid Data Statements
AGN	AGLTERM, AGPSB, AGTRAN
COMMAND	PASSWORD, TERMINAL
CTRANS	TCOMMAND
DATABASE	PASSWORD
PASSWORD	COMMAND, DATABASE, PROGRAM, PTERM, TERMINAL, TRANSACT
PROGRAM	PASSWORD
PTERM	PASSWORD
SIGN	STERM, LINE, TERMINAL
TCOMMAND	CTRANS
TERMINAL	COMMAND, PASSWORD, TRANSACT

TRANSACT	PASSWORD, TERMINAL

Output for DFSISMP0

Output from the Security Maintenance utility consists of up to six sequential members that are placed in IMS.MATRIX.

Restriction: These members cannot be reprocessed using the linkage editor.

The contents and names of the six members output from the Security Maintenance Utility are shown in Table 22:

Table 22. Security Maintenance Utility Output Descriptions

Contents	Name
Communication Password Table/Matrix	DFSISPBx
Terminal Offset List	DFSISTLx
Transaction Command Matrix	DFSISTCx
Transaction Offset List and Table	DFSISTTx
Sign-on Table	DFSISSOx
Application Group Name Table	DFSAGTOx

The utility also provides a listing of the maintenance tables created. Each run of the utility replaces previously created members. A set of security maintenance tables can be maintained for each IMS online control program nucleus. It is identified by the last character of the IMS nucleus name.

Security-Status Reports

Each execution of the utility produces a printed analysis of the IMS system for which security is being maintained. If errors are encountered in processing the input control statements, no security block update functions are performed. Instead, diagnostic error messages are produced for the entire input stream.

You can also request a no-update execution of the Security Maintenance utility to produce a printed analysis of your IMS system security specifications. This run, using the LIST option on the EXEC statement in Step S (under “Invoking the Procedure” on page 223) ends with a return code of 16.

Examples of DFSISMP0

The following examples show the input statements for the Security Maintenance utility.

Example 1

This example illustrates passwords assigned to each program.

```
)( PROGRAM     ACCT
    PASSWORD   DOLLAR

)( PROGRAM     ENG560
    PASSWORD   PARTNO
)( PROGRAM     LOGREC
```

```
    PASSWORD   NONE

)( PROGRAM     AGC0568
    PASSWORD   MONEY
```

Example 2

This example illustrates passwords assigned to each database.

```
)( DATABASE    ACCTLOG
    PASSWORD   LOG

)( DATABASE    ACCTREC
    PASSWORD   REC

)( DATABASE    ACTIVITY
    PASSWORD   ACTIVE

)( DATABASE    ENGREC
    PASSWORD   PIERSQ

)( DATABASE    PARTSREC
    PASSWORD   PIERSQ

)( DATABASE    PARTSREC
    PASSWORD   ASSY
```

Example 3

This example illustrates passwords assigned to commands.

```
)( COMMAND     CHANGE
   PASSWORD    PSWD1

)( COMMAND     PURGE
   PASSWORD    PSWD2
```

Example 4

This example illustrates passwords assigned to transaction codes and a list of terminals that can use each transaction code. With the list of terminals is the required password restricting some IMS terminal commands to the master terminal only.

```
)( TRANSACT    ACCTCHG
    PASSWORD   CHARGE
    TERMINAL   A875111
    TERMINAL   C8751112
    TERMINAL   D8751113
    TERMINAL   A8751114
    TERMINAL   A8751115

)( TRANSACT    ACTY
    PASSWORD   GO
    TERMINAL   A8751111
    TERMINAL   C8751112
    TERMINAL   D8751113
    TERMINAL   A8751114
    TERMINAL   A8751115

)( TRANSACT    TNL
    PASSWORD   QTY
    TERMINAL   DEPT650
    TERMINAL   DEPT610
    TERMINAL   DEPT620
    TERMINAL   DEPT631
    TERMINAL   DEPT632
    TERMINAL   DEPT630
```

Examples

```
    TERMINAL   DEPT640
    TERMINAL   DEPT641
    TERMINAL   DEPT642

)( TRANSACT    ING
    PASSWORD   QUESTION
    TERMINAL   DEPT310
    TERMINAL   DEPT311
    TERMINAL   DEPT312
    TERMINAL   DEPT410
    TERMINAL   DEPT411
    TERMINAL   DEPT412
    TERMINAL   DEPT510
    TERMINAL   DEPT511
    TERMINAL   DEPT512
    TERMINAL   DEPT100
    TERMINAL   DEPT200
    TERMINAL   DEPT686
    TERMINAL   MASTER
    TERMINAL   ALTMAST
    TERMINAL   MAINT

)( TRANSACT     INVNTRY
    PASSWORD    SUBASSY
    TERMINAL    DEPT310
    TERMINAL    DEPT311
    TERMINAL    DEPT312
    TERMINAL    DEPT410
    TERMINAL    DEPT410
    TERMINAL    DEPT411
    TERMINAL    DEPT412
    TERMINAL    DEPT510
    TERMINAL    DEPT511
    TERMINAL    DEPT512
    TERMINAL    DEPT100
    TERMINAL    DEPT200
    TERMINAL    DEPT686
    TERMINAL    MASTER
    TERMINAL    ALTMAST
    TERMINAL    MAINT
    TERMINAL    DEPT710
    TERMINAL    DEPT720
    TERMINAL    DEPT848
    TERMINAL    DEPT850
    TERMINAL    DEPT900
    TERMINAL    TEST1
    TERMINAL    TEST2

)( TRANSACT     ACCT
    PASSWORD    LEDGER
    TERMINAL    DEPT310
    TERMINAL    DEPT311
    TERMINAL    DEPT312
    TERMINAL    DEPT410
    TERMINAL    DEPT411
    TERMINAL    DEPT412
    TERMINAL    DEPT510
    TERMINAL    DEPT511
    TERMINAL    DEPT512
    TERMINAL    DEPT100
    TERMINAL    DEPT200
    TERMINAL    DEPT686
    TERMINAL    MASTER
    TERMINAL    ALTMAST
    TERMINAL    MAINT
```

Example 5

This example illustrates that the master terminal can enter a subset of IMS terminal commands and transaction codes defined by the system definition example in this manual.

```
)( TERMINAL     MASTER
    TRANSACT    ACCTCHG
    TRANSACT    ACTY
    TRANSACT    TNL
    TRANSACT    INQUIRY
    TRANSACT    INQ
    TRANSACT    ENG
    TRANSACT    ACCT
    COMMAND     BROADCAST
    COMMAND     START
    COMMAND     STOP
    COMMAND     PSTOP
    COMMAND     PURGE
    COMMAND     CHANGE
    COMMAND     DELETE
    COMMAND     ASSIGN
    COMMAND     CHECKPOINT
    COMMAND     DBDUMP
    COMMAND     NRESTART
    COMMAND     ERESTART
    COMMAND     DBRECOVERY
    COMMAND     IDLE
    COMMAND     RSTART
    COMMAND     DISPLAY
```

Example 6

This example illustrates a list of terminals that must enter a sign-on command to gain access to IMS.

```
)( SIGN
   STERM        ALL

)( SIGN
   STERM 4
   STERM 09
   STERM 105
   STERM VTAM
   STERM V3270

)( SIGN
   STERM LINE 3 TERMINAL 4
   STERM LINE 5 TERMINAL 2
```

Example 7

This example illustrates the relating of transactions to commands.

```
)( CTRANS       ADDPART
   TCOMMAND     *

)( TCOMMAND     STOP
   CTRANS       ADDINV
   CTRANS       APOL11
   CTRANS       APOL12

)( CTRANS       APOL13
   TCOMMAND     COMPT
```

Example 8

This example illustrates a list of programs, transactions, and logical terminals whose access is restricted to the region associated with the AGN name.

```
)( AGN          TEST005
   AGPSB        DDLTBP01
   AGTRAN       TRAN13C0
   AGLTERM      DD3270L4

)( AGN          TEST003
   AGPSB        ALL
   AGTRAN       ALL
   AGLTERM      ALL

)( AGN          TEST004
   AGPSB        APOL1
   AGPSB        A3270
   AGPSB        GISBMP09
   AGTRAN       ADDINV
   AGTRAN       APOL15
   AGLTERM      TERM0001
   AGLTERM      TERM0002
   AGLTERM      TERM0003
   AGLTERM      TERM0004

)( AGN          TEST002
   AGPSB        A3270
   AGTRAN       ADDINV

)( AGN          TEST002
   AGPSB        INTCON
```

Chapter 7. Online Change Utilities and Procedures

You can use Online Change to make changes to some IMS system resources without stopping the system. This chapter describes some of the utilities and procedures used to prepare the system for online changes.

The following topics provide additional information:

- "Online Change Copy Utility (DFSUOCU0)"
- "INITMOD Procedure" on page 236
- "Global Online Change Utility (DFSUOLC0)" on page 238

Online Change Copy Utility (DFSUOCU0)

You must run the Online Change Copy utility as one step in the process of preparing an IMS or an IMSplex for a local or global online change. The Online Change Copy utility copies a source library with your new definitions to a target library. In an IMSplex where IMS subsystems are not cloned and the libraries not shared, the Online Change Copy utility might need to be executed on every IMS in the IMSplex. In an IMSplex where IMS subsystems are cloned and the libraries are shared, the Online Change Copy utility might need to be executed only once on one IMS.SDFSRESL at the highest IMS level.

The Online Change Copy utility can copy the contents of the staging libraries to the active libraries during the installation of IMS, prior to the first cold start. To do this, the parameter for the output ddname must be specified when invoking the utility, because the initial contents of IMS.MODSTAT (or OLCSTAT data set, if global online change is enabled) will specify the active libraries. Issuing the Online Change command sequence to prepare and commit an online change causes the inactive library to become the active library. Using a z/OS serialization service, this utility prevents other utilities from updating the staging (source) or inactive (target) libraries while the copy is in progress.

Related Reading: For more information on IMS.MODSTAT, see *IMS Version 9: Installation Volume 1: Installation Verification*.

Requirements for Online Change Copy

Three copies of the following libraries are required for online change:

ACBLIB	Database and program descriptors such as DMBs and PSBs
FORMAT	Control blocks produced by the MFS language utility and service utility
MATRIX	Control blocks for the system security tables
MODBLKS	A subset of the control blocks for the resources to be modified

One copy of each library is used exclusively for offline functions. This library has no suffix and is called the staging library.

The other two copies of each library have a suffix of A or B. Only one of these libraries is used by the IMS online system at any one time. The one in use is referred to as the active library. The other is called the inactive library.

The Online Change Copy utility can copy the contents of the staging library to the inactive library based on the information in the status data set, MODSTAT.

The same method of serialization prevents this utility from updating the active libraries while they are being used by an IMS online system.

Restrictions for Online Change Copy

The following restrictions apply to the Online Change Copy utility:

- If any of the ACBLIB, FORMAT, or MODBLKS libraries are shared among IMS systems, all systems must use the same libraries during execution of this utility.
- In an XRF environment ACBLIBs, FORMATs, MATRIXs, and MODBLKs data sets must be on shared non-duplex DASD for error protection. Make the same additions or changes to separate but duplicate copies of IMS data sets.
- You cannot use the Online Change Copy utility to make additions or changes that require new IMS modules to be added to the IMS.SDFSRESL data set.
- You cannot add, modify, or delete MSDBs using this utility. However, PSB related changes for MSDBs can be made to the ACBLIBs, as long as no DBD changes are included.
- You cannot add, modify, or delete partitions of a HALDB using this utility, only by using the Partition Definition utility. However, PSB related changes for HALDB can be made to the ACBLIBs, as long as no DBD changes are included.
- In an RSR environment, this utility has no effect on the copies of the ACBLIBx, FORMATx, MATRIXx, MODBLKSx, and MODSTAT data sets used on the tracking subsystem for tracking an active subsystem.

If the Online Change Copy utility is cancelled prior to completion, the status of the ACBLIB, FMTLIB, or MODBLKS data set is unpredictable. The data set being changed by the utility is cleared as soon as the utility has exclusive control of the data set, and then new information is written to the data set. If the utility is cancelled prior to its successful completion the data set is virtually useless.

Procedure for Online Change Copy

Figure 75 on page 233 shows the OLCUTL statements used to invoke the Online Change Copy utility, OLCUTL procedure. This procedure is generated by system definition and is placed in the IMS.PROCLIB by stage two of system definition.

OLCUTL clears the target library data set and then invokes IEBCOPY to move the source library contents. If IEBCOPY abends because of insufficient space, the contents of the target library are unpredictable. To avoid this, allocate equal amounts of space for source and target libraries.

```
//       PROC TYPE=,IN=,OUT=,SOUT=A,SYS=,SYS2=,OLCGLBL='DUMMY,',OLCLOCL=
//S      EXEC PGM=DFSUOCU0,PARM=(&TYPE,&IN,&OUT)
//STEPLIB  DD DSN=IMS.&SYS2.SDFSRESL,DISP=SHR
//MODBLKS  DD DSN=IMS.&SYS2.MODBLKS,DISP=SHR
//MODBLKSA DD DSN=IMS.&SYS2.MODBLKSA,DISP=SHR
//MODBLKSB DD DSN=IMS.&SYS2.MODBLKSB,DISP=SHR
//IMSACB   DD DSN=IMS.&SYS2.ACBLIB,DISP=SHR
//IMSACBA  DD DSN=IMS.&SYS2.ACBLIBA,DISP=SHR
//IMSACBB  DD DSN=IMS.&SYS2.ACBLIBB,DISP=SHR
//FORMAT   DD DSN=IMS.&SYS2.FORMAT,DISP=SHR
//FORMATA  DD DSN=IMS.&SYS2.FORMATA,DISP=SHR
//FORMATB  DD DSN=IMS.&SYS2.FORMATB,DISP=SHR
//MATRIX   DD DSN=IMS.&SYS2.MATRIX,DISP=SHR
//MATRIXA  DD DSN=IMS.&SYS2.MATRIXA,DISP=SHR
//MATRIXB  DD DSN=IMS.&SYS2.MATRIXB,DISP=SHR
//MODSTAT  DD &OLCLOCL.DSN=IMS.&SYS.MODSTAT,
//         DISP=SHR
//MODSTAT2 DD &OLCLOCL.DSN=IMS.&SYS.MODSTAT2,
//         DISP=SHR
//OLCSTAT  DD &OLCGLBL.DSN=IMSPLEX.OLCSTAT,
//         DISP=OLD
//SYSUDUMP DD SYSOUT=&SOUT
//SYSPRINT DD SYSOUT=&SOUT
//SYSUT3   DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//SYSUT4   DD UNIT=SYSDA,SPACE=(CYL,(1,1))
//COPYCTL  DD DSN=&&COPYCTL,DISP=(NEW,DELETE),
//         UNIT=SYSDA,SPACE=(CYL,(1,1))
```

Figure 75. OLCUTL Procedure

Procedure Statement

The procedure statement must be in the following form to include optional IEBCOPY parameters:

```
PROC TYPE=,IN=,OUT=,SOUT=A,SYS=,SYS2=,OLCGLBL='DUMMY,',OLCLOCL=
```

OLCGLBL=
OLCLOCL=

These parameters produce the OLCSTAT DD card or the MODSTAT/MODSTAT2 DD cards.

OLCGLBL='DUMMY,',OLCLOCL=

Produced by Stage 2 system definition. This parameter results in the OLCUTL procedure being set up for local online change as the default with the following DD statements:

```
//MODSTAT  DD &OLCLOCL.DSN=IMS.&SYS.MODSTAT,DISP=SHR
//MODSTAT2 DD &OLCLOCL.DSN=IMS.&SYS.MODSTAT2,DISP=SHR
//OLCSTAT  DD &OLCGLBL.DSN=IMSPLEX.OLCSTAT,DISP=OLD
```

For global online change is desired, set the OLCGLBL= and OLCLOCL= parmeters as follows:

```
OLCGLBL=,OLCLOCL='DUMMY,'
```

These parameters generate the following DD statements to be used for global online change:

```
//MODSTAT DD DUMMY,DSN=IMS.&SYS..MODSTAT,DISP=SHR
//MODSTAT2 DD DUMMY,DSN=IMS.&SYS..MODSTAT2,DISP=SHR
//OLCSTAT DD DSN=IMSPLEX.OLCSTAT,DISP=OLD
```

SOUT=

Specifies the class assigned to SYSOUT DD statements.

SYS=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Mandatory Shared” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS='IMSA.'

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS2='IMSA.'

EXEC Statement

The EXEC statement determines which copy is made and which data sets are used for input and output. The format of this statement can include optional IEBCOPY parameters specified in the order of WORK, SIZE, LIST after the target_library. If one or more of them is specified, the following combinations are valid:

- WORK=
- WORK=,SIZE=
- WORK=,SIZE=,LIST=

The IEBCOPY options list, containing the IEBCOPY keywords, equal signs, parameter values, and commas, cannot exceed 64 bytes. The IEBCOPY parameters are passed to the IEBCOPY utility when the utility is called. See *DFSMSdfp Utilities* for details on the IEBCOPY parameters. The following is a sample EXEC statement:

```
PGM=DFSUOCU0,PARM=(copy_type,input_library,target_library,work,size,list)
```

copy_type
Specifies the library to be copied. Copy-type can be the ACB, FORMAT, MATRIX, or MODBLKS library.

input_library
Defines the library ddnames to be used as input.

Parameter	Meaning
S	IMS staging library (IMSACB, FORMAT MATRIX, or MODBLKS)
I	User input library (IMSACBI, FORMATI, or MODBLKSI)

The I parameter allows you to use an input library other than the staging library.

target_library
Defines the library ddnames to be used for output.

Parameter	Meaning
A	IMS A library (IMSACBA, FORMATA, MATRIXA, or MODBLKSA)
B	IMS B library (IMSACBB, FORMATB, MATRIXB, or MODBLKSB)
G	Target library (inactive) determined by the utility, using the OLCSTAT data set. The target is the library not currently in use by the IMS online system.
O	User output library (IMSACBO, FORMATO, MATRIXO, or MODBLKSO)

U Target library (inactive) determined by the utility, using the MODSTAT data set. The target is the library not currently in use by the IMS online system.

Recommendation: During online operation, avoid using the A or B parameter for the output library because an incorrect choice could cause IMS to overlay the active library.

The O parameter allows you to select a target data set other than the active or inactive data set.

Recommendation: Specify the U parameter or an IMS that supports local online change. G is recommended for an IMSplex that supports global online change.

work
Optional parameter that passes the work parameter to the IEBCOPY utility. The work parameter passes the number of bytes of virtual storage to request for a work area to hold for directory entries, internal tables, and I/O buffers.

size
Optional parameter that passes the size parameter to the IEBCOPY utility. The size parameter specifies the maximum number of bytes of virtual storage that the IEBCOPY utility can use as a buffer.

This parameter can only be specified if the work parameter is also specified.

list
Optional parameter that passes the list parameter to the IEBCOPY utility. LIST=NO suppresses IEBCOPY IEB1541 messages that are issued for each member that is successfully copied.

This parameter can only be specified if the work and size parameters are also specified.

DD Statements

IMSACB DD
IMSACBA DD
IMSACBB DD
Defines the staging, active, or inactive ACBLIB.

FORMAT DD
FORMATA DD
FORMATB DD
Defines the staging, active, or inactive MFS format library.

OLCSTAT DD
Defines the global online change status data set name for an IMS enabled for global online change. The OLCSTAT data set is similar to the MODSTAT data set used for local online change. The OLCSTAT DD should not be defined if local online change is enabled

MATRIX DD
MATRIXA DD
MATRIXB DD
Defines the staging, active, or inactive library containing the security tables.

MODBLKS DD
MODBLKSA DD
MODBLKSB DD
Defines the staging, active, or inactive system definition library.

MODSTAT DD
MODSTAT2 DD
Defines the local online change modify status data set names. This is the active data set (and inactive data set, if XRF is used) that online IMS should use at initialization.

SYSUDUMP DD
Defines the dump data set for this program. The data set can reside on a printer, tape, or direct-access device, or be routed through the output stream.

SYSPRINT DD
Defines the message output data set. The data set can reside on a printer, tape, or direct-access device, or be routed through the output stream. This DD statement must always be included.

SYSUT3 DD
Defines a work data set that is required.

SYSUT4 DD
Same function as SYSUT3.

COPYCTL DD
Defines a copy control data set to be built prior to calling IEBCOPY.

Invoking the Procedure

Figure 76 shows the JCL statements used to copy the staging libraries to the active libraries.

```
//*  COPY MODBLKS TO MODBLKSA
//*
//STEP01  EXEC PROC=OLCUTL,SOUT='*',TYPE=MODBLKS,IN=S,OUT=U
//*
//*  COPY MATRIX TO MATRIXA
//*
//STEP02  EXEC PROC=OLCUTL,SOUT='*',TYPE=MATRIX,IN=S,OUT=U
//*
//*  COPY ACBLIB TO ACBLIBA
//*
//STEP03  EXEC PROC=OLCUTL,SOUT='*',TYPE=ACB,IN=S,OUT=U
//*
//*  COPY FORMAT TO FORMATA
//*
//STEP04  EXEC PROC=OLCUTL,SOUT='*',TYPE=FORMAT,IN=S,OUT=U
//*
//*  COPY FORMAT TO FORMAT WITH IEBCOPY PARAMETERS SPECIFIED
//*
//STEP05  EXEC PROC=OLCUTL,SOUT='*',TYPE=FORMAT,IN=S,OUT=U,WORK=2M,SIZE=2M,LIST=NO
//*
//*
```

Figure 76. JCL Used to Copy Staging Library to Inactive Libraries Indicated by MODSTAT Data Set

INITMOD Procedure

The INITMOD procedure initializes the IMS.MODSTAT data set, for an IMS enabled with local online change. The MODSTAT data set must be initialized before the first IMS cold start or before any other cold start if IMS.MODSTAT does not contain the current ddnames. If IMS is enabled for global online change, it will not use the MODSTAT data set.

Recommendation: Do not define the MODSTAT DD cards if enabling global online change, and the MODSTAT data sets will not have to be defined.

Stage two of system definition places the INITMOD procedure in the IMS.PROCLIB procedure library. Figure 77 shows the JCL required for the INITMOD procedure.

```
//INIT1  EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=&SOUT
//SYSUT2   DD DSN=IMS.&SYS.MODSTAT&SF,DISP=OLD
//SYSIN    DD DUMMY
//SYSUT1   DD DISP=SHR,
//         DSN=IMS.&SYS2.PROCLIB(DFSMREC)
```

Figure 77. JCL for the INITMOD Procedure

Procedure Statement

The procedure statement must be in the form:

```
PROC SYS=,SYS2=,SF=,SOUT=A
```

SYS=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Mandatory Shared” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS='IMSA.'

SYS2=
Specifies an optional second level dsname qualifier for those data sets which are designated as “Optional Replicate” in an XRF complex. When specified, the parameter must be enclosed in quotes and must include a trailing period; for example, SYS2='IMSA.'

SF=
Specifies the suffix for the MODSTAT data set name, either SF= or SF=2.

SOUT=
Specifies the class assigned to SYSOUT DD statements.

DFSMREC Control Statement

The INITMOD procedure uses this control statement to initialize the MODSTAT data sets. DFSMREC contains the data for the MODSTAT record. This control statement is created at system definition and is placed in the IMS.PROCLIB procedure library. The statement must be in the form:

```
0,MODBLKSA,IMSACBA,FORMATA
```

Values must be separated by commas, with no imbedded blanks.

0 Is the MODSTAT identifier, which is variable length with no limit. This positive value, initialized to zero, is used by IMS internal processing for recovery of security status during emergency restart processing. You can initialize it to zero at any IMS cold start.

MODBLKSA
Is the ddname for the active IMS.MODBLKSA (B) data set that contains the IMS system definition output. This also means that the ddname for the active IMS.MATRIXA (B) has the same suffix (MATRIXA).

If MODBLKSA is specified for example, IMS assumes that MATRIXA is the active IMS.MATRIXA (B) library used for security maintenance utility output.

IMSACBA
Is the ddname in the IMS procedure for the active IMS.ACBLIBA(B) library.

FORMATA
Is the ddname of the active IMS.FORMATA (B) data set which contains online MFS definitions to be used as the format library by the online system. MFS-supported terminals and the MFS language utility program require their use. When one of these libraries is active (that is, in use by the online system), the contents of IMS.FORMAT is copied to the other, or inactive, library for use in the next online change run. Their ddnames must be FORMATA and FORMATB, respectively. If MFS is not defined, IMS ignores this ddname.

If the IMS.MODSTAT record contents are lost and must be reconstructed, or if you do not use default initialization by the INITMOD procedure, you must run an IEBGENER job to construct its contents with the proper values for the online change identifier and ddnames. The attributes for a new IMS.MODSTAT data set should be RECFM=F and BLKSIZE=80.

Figure 78 shows initialization of the MODSTAT ID to 3, and the ddnames to MODBLKSB, IMSACBA, and FORMATA.

```
//INIT1  EXEC PGM=IEBGENER
//SYSPRINT DD SYSOUT=&SOUT
//SYSUT2   DD DSN=IMS.&SYS.MODSTAT&SF,DISP=OLD
//SYSIN    DD DUMMY
//SYSUT1   DD DISP=SHR,
//         DSN=IMS.&SYS2.PROCLIB(DFSMREC)
./       ADD  NAME=DFSMREC
./       NUMBER NEW1=10,INCR=10
0,MODBLKSA,IMSACBA,FORMATA
```

Figure 78. IEBGENER Job

Alternatively, you can override SYSUT1 and SYSUT2 DD statements of the INITMOD procedure to accomplish the same purpose as the preceding IEBGENER sample job.

The DFS3499 message, which identifies the current values of the MODSTAT record, follows the DFS994 checkpoint message. The DFS3410 message at initialization also identifies the MODSTAT record data.

Global Online Change Utility (DFSUOLC0)

You can use the Global Online Change utility to initialize, recreate, or unlock the OLCSTAT data set. For an IMSplex to be enabled for global online change, the Global Online Change utility must be used to initialize the OLCSTAT before the first IMS in the IMSplex cold starts the first time. The Global Online Change utility can be used to recreate the OLCSTAT data set after an error that renders the OLCSTAT data set unusable.

The Global Online Change commands, `INITIATE OLC PHASE(PREPARE)`, followed by `INITIATE OLC PHASE(COMMIT)`, cause the inactive library to become the active library.

The OLCSTAT data set contains the global online change status, which includes the modify id, the active online change libraries, a lock field, the last online change, and a list of IMSs that are current with the online change libraries. When an IFP region

is running, OLC commit stops because of existing active route code. Therefore, all IFP regions must be terminated before commit.

The Online Change Copy utility supports an OLCSTAT DD statement, to identify the global online change status data set name. The OLCSTAT data set is comparable to the MODSTAT data set used by local Online Change. (See “Online Change Copy Utility (DFSUOCU0)” on page 231.)

Attention: Use the recreate and unlock functions with extreme caution. Use the unlock function only if a series of errors has left the OLCSTAT data set locked and no online change is in progress. If you inadvertently destroy valid OLCSTAT data set contents, global online change and initialization of additional IMSs fail until the OLCSTAT data set is re-initialized.

Establish an OLCSTAT data set recovery procedure to deal with the loss of the OLCSTAT data set. After every successful global online change, record the following data:

- The modify id
- The active online change library suffixes
- The list of IMSs that are current with the online change libraries

If the OLCSTAT data set is destroyed, run the initialize function of the Global Online Change utility with the recorded data to re-initialize the OLCSTAT data set.

The DFS3499 message, which identifies the current values of the online change libraries in the OLCSTAT data set, follows the DFS994 checkpoint message. The DFS3410 message at initialization also identifies the current online change libraries from the OLCSTAT data set.

Related Reading: For more information about the OLCSTAT data set, see *IMS Version 9: Installation Volume 1: Installation Verification*.

JCL Requirements for DFSUOLC0

The JCL shown in Figure 79 shows the statements used to invoke the DFSUOLC procedure. This procedure is generated by stage 2 of system definition and placed in the IMS.PROCLIB.

```
//PROC FUNC=,ACBS=,MDBS=,FMTS=,MDID=,PLEX=,SOUT=A
//STEP1 EXEC PGM=DFSUOLC0,PARM=(&FUNC,&ACBS,&MDBS,&FMTS,&MDID,&PLEX)
//STEPLIB DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//SYSUDUMP DD SYSOUT=&SOUT
//OLCSTAT DD DSN-IMSPLEX.OLCSTAT,DISP=OLD
//SYSPRINT DD SYSOUT=&SOUT
//SYSIN DD DUMMY
```

Figure 79. DFSUOLC Procedure

The following JCL will run with the DFSUOLC procedure and invoke the utility.

```
//DFSUOLC0 JOB
//STEP1 EXEC DFSUOLC,FUNC=,ACBS=,MDBS=,FMTS=,MDID=,PLEX=,
//SYSIN DD *
/*
//
```

The format of the EXEC statement is:

```
PGM=DFSUOLC0,PARM=(FUNC=&FUNC,ACBS=&ACBS,MDBS=&MDBS,FMTS=&FMTS,
MDID=&MDID,PLEX=&PLEX,SOUT=&SOUT)
```

The Global Online Change utility (DFSUOLC0) supports the following parameters.

ACBS Specifies the IMS JCL IMSACB DD statement suffix for the active ACB library. The suffix can be A or B. A means IMSACBA is the DD statement of the active library. B means IMSACBB is DD statement of the active library.

FMTS Specifies the IMS JCL FORMAT DD statement suffix for the active MFS FORMAT library. The suffix can be A or B. A means FORMATA is the DD statement of the active library. B means FORMATB is the DD statement of the active library. FORMAT contains online MFS definitions to be used as the format library by the online system. MFS-supported terminals and the MFS language utility program require their use. This statement is required, even if no IMS in the IMSplex uses the MFS format library.

FUNC Specifies the Global Online Change utility function to perform.

ADD
Add one or more IMS members to the list of IMSs that are current with the online change libraries. Add an IMS when the OLCSTAT data set suffered an error that made it unusable and you are trying to recreate the OLCSTAT data set contents. The IMSs to add must be specified with the SYSIN DD card.

Add IMSs that are current with the online change libraries; for example, IMSs that are currently up.

Attention: If you add an IMS that is not current with the online change libraries, and warm start that IMS, the warm start might fail.

DEL
Delete one or more IMSs from the list of IMSs that are current with the online change libraries.

Delete an IMS when you never intend to bring the IMS up again, so that the `INITIATE OLC` command does not need to be specified with the FRCABND or FRCNRML keyword. The IMSs to delete must be specified with the SYSIN DD card.

INI
Function to initialize the OLCSTAT data set. ACBS, MDBS, FMTS, and MDID must also be specified. An optional list of one or more IMSs can be specified with the SYSIN DD statement. If no IMSs are specified with the SYSIN DD statement, the list of IMSs is deleted from the OLCSTAT data set.

The INI function is required before the first IMS in the IMSplex cold starts the first time to initialize the OLCSTAT data set.

If the OLCSTAT record contents are lost and must be reconstructed, you must run the Global Online Change utility INI function to construct its contents with the correct values for the online change identifier and online change library ddnames. You might also want to add IMSs that are current with the online change libraries using the SYSIN DD statement. Keep track of

the current online change libraries and modify id so that you can reconstruct the OLCSTAT data set contents in case of failure.

UNL
Function to reset the OLCSTAT data set lock after all IMSs failed during online change.

The UNL function of the Global Online Change utility is required to reset the OLCSTAT data set lock, in the case where all IMSs in the IMSplex failed during an online change. Online change sets a lock field in the OLCSTAT data set to prevent other IMSs from initializing during the online change. IMS initialization fails if a global online change is in progress (between the prepare and commit phases), because the OLCSTAT data set lock is set. When an IMS tries to initialize after all IMSs failed during online change, IMS initialization is rejected because the OLCSTAT data set lock is set. In this case, you must run the Global Online Change utility with the UNL function to reset the OLCSTAT data set lock. No IMS can initialize until the OLCSTAT data set lock is reset. The UNL function should rarely need to be used. It is needed only if all the IMSs fail during an online change.

MDBS Specifies the IMS JCL MODBLKS DD statement suffix for the active MODBLKS data set and the IMS JCL MATRIX DD statement suffix for the active MATRIX data set. The suffix can be A or B. A means MODBLKSA and MATRIXA are the DD statements of the active libraries. B means MODBLKSB and MATRIXB are the DD statements of the active libraries.

MDID Specifies the modifyid (online change status identifier) for the INI function. This should be initialized to zero to indicate that the number of global online changes performed is zero. The modifyid is used to determine whether an IMS was down for one or more online changes and to determine the kind of restart IMS can perform. The modifyid is used by IMS internal processing:

- To determine whether IMS must cold start.

  If an IMS participated in the last global online change, its modifyid matches the modifyid in the OLCSTAT data set. This IMS is allowed to warm start. If an IMS did not participate in the last global online change, its modifyid does not match the modifyid in the OLCSTAT data set. It is permitted to warm start if its restart type does not conflict with the last online change that was performed. If the IMS was down for two or more global online changes, it must cold start.
- To recover security status during emergency restart processing.

PLEX Specifies a 1-5 character identifier that specifies the XCF CSL IMSplex group name for the UNL function. PLEX is required for the UNL function. All OM, RM, SCI, IMS, and so on, IMSplex members that are in the same IMSplex sharing group sharing either data bases or message queues must specify the same identifier. The same identifier must also be used for the IMSPLEX= parameter in the CSLSIxxx, CSLOIxxx, CSLRIxxx and DFSCGxxx PROCLIB members.

SOUT Specifies the class assigned to SYSOUT DD statements.

The STEPLIB DD statement identifies the IMS.SDFSRESL. The IMS.SDFSRESL contains the IMS required modules. This IMS.SDFSRESL must be the highest level available in the IMSplex.

The SYSUDUMP DD statement defines the dump data set for this program.

The SYSPRINT DD statement defines the message output data set.

The OLCSTAT DD statement identifies the OLCSTAT (global online change status) data set name. The OLCSTAT DD statement is required.

The SYSIN DD statement contains the list of IMSs to define, add, or delete. Specify one IMS ID per line.

The SYSIN DD statement specified with the ADD function adds one or more IMSs to the existing list of IMSs in the OLCSTAT data set.

The SYSIN DD statement specified with the DEL function deletes one or more IMSs from the existing list of IMSs in the OLCSTAT data set.

The SYSIN DD statement specified with the INI function defines a new list of IMSs. If IMS records already existed, they are wiped out.

Examples of Global Online Change

Global Online Change utility Example 1

The following example shows the JCL for the Global Online Change utility to initialize the OLCSTAT data set before the first IMS cold starts the first time.

```
//DFSUOLC0 JOB
//STEP1 EXEC DFSUOLC,FUNC=INI,ACBS=A,MDBS=A,FMYS=A,MDID=0
//SYSIN DD *
/*
//
```

Global Online Change Utility Example 2

The following example shows the JCL for the Global Online Change utility that initializes the OLCSTAT data set header. You should rarely need to include a list of IMSs when initializing the OLCSTAT data set header. For example, if the OLCSTAT data set became unusable, you would have to initialize the OLCSTAT header. If you know which IMSs are current with the online change libraries, you could include those IMSs in the list. If IMSIDs are not specified, no IMSID will be listed on the OLCSTAT data set record.

```
//DFSUOLC0 JOB
//STEP1 EXEC DFSUOLC,FUNC=INI,ACBS=A,MDBS=A,FMTS=A,MDID=0
//SYSIN DD
IMSA
IMSB
/*
//
```

Part 3. Log Utilities

Chapter 8. Dynamic SVC Utility (DFSUSVC0)

The Dynamic Supervisor Call (SVC) utility allows you to install an updated version of the IMS Type 2 SVC or DBRC Type 4 SVC without requiring an IPL of the z/OS operating system by changing the z/OS SVC table to point to a new copy of the SVC module.

This utility runs as a z/OS job.

The following topics provide additional information:

- "Restrictions for DFSUSVC0"
- "Input and Output for DFSUSVC0"
- "Return Codes for DFSUSVC0"
- "DFSUSVC0 JCL Requirements" on page 246
- "Examples of DFSUSVC0" on page 246

Restrictions for DFSUSVC0

The following restrictions apply to the Dynamic SVC utility:

- The JCL must contain a DFSRESLB DD statement that references an IMS RESLIB.
- The updated SVC module (either IMS Type 2 SVC, DBRC Type 4 SVC, or both) must be in an IMS RESLIB specified on the DFSRESLB DD statement.
- The IMS RESLIB must reflect the correct SVC number to be replaced. This value is created by IMS system definition and is stored in the IMS RESLIB. You can introduce an error by pointing to the wrong library where a different SVC number (or even non-IMS SVC number) can be associated with this library. **Check with your system administrator before using this utility.**
- The IMS RESLIB that contains the SVC numbers and the new SVC modules must be an APF-authorized library (standard IMS installation).
- The utility program must reside in an APF-authorized library (usually the IMS RESLIB, but this is not a requirement).
- No IMS image (control region, batch, or utility) that uses the IMS Type 2 SVC can be active while attempting to update the Type 2 SVC module. The same restriction does not apply to the DBRC Type 4 SVC module.

Input and Output for DFSUSVC0

The input to this utility is either the updated IMS Type 2 SVC module, the updated DBRC Type 4 SVC module, or both. The updated SVC modules must reside in the library that is pointed to by the DFSRESLB DD statement.

The utility determines which SVCs to update and dynamically changes the z/OS SVC table to point to the new SVC modules.

Return Codes for DFSUSVC0

The following return codes are produced:

Code	Meaning

0	Dynamic installation was successful. All specified SVC routines were successfully updated.
8	The installation of at least one of the specified SVC routines failed.

DFSUSVC0 JCL Requirements

The Dynamic SVC utility is executed as a standard z/OS job. You must supply the following:

- A JOB statement
- An EXEC statement
- DD statements that define inputs

EXEC Statement

The EXEC statement must be in one of the following forms:

```
//STEP001 EXEC PGM=DFSUSVC0
```

or

```
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(2)'
```

or

```
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(4)'
```

or

```
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(2,4)'
```

The EXEC statement allows you to specify whether the IMS Type 2 SVC module, the DBRC Type 4 SVC module, or both are to be updated. When `SVCTYPE=(2)` is specified, the IMS Type 2 SVC module is updated. When `SVCTYPE=(4)` is specified, the DBRC Type 4 SVC is updated. When `SVCTYPE=(2,4)` is specified, both the IMS Type 2 SVC and the DBRC Type 4 SVC module are updated. If a value is not specified for the `SVCTYPE=` parameter, the IMS Type 2 SVC module is updated by default.

DD Statements

STEPLIB DD

Points to an authorized library that contains the actual DFSUSVC0 utility. The authorized library should be in your IMS RESLIB).

```
//STEPLIB  DD  DSN=SOME.APF.AUTHORIZED.DATASET,DISP=SHR
```

DFSRESLB DD

Points to an authorized library that contains the updated SVC modules and the IMS Type 2 and DBRC Type 4 SVC numbers.

```
//DFSRESLB DD  DSN=SOME.IMS.SDFSRESL,DISP=SHR
```

Examples of DFSUSVC0

Figure 80 on page 247, Figure 81 on page 247, and Figure 82 on page 247 show the JCL needed to replace the IMS Type 2 SVC and the DBRC Type 4 SVC.

```
//SVCINIT  JOB MSGLEVEL=1,TIME=1440
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(2)'
//STEPLIB  DD  DSN=SOME.APF.AUTHORIZED.DATASET,
//             DISP=SHR
//DFSRESLB DD  DSN=SOME.IMS.SDFSRESL,
//             DISP=SHR
```

Figure 80. Example for Replacing IMS Type 2 SVC

```
//SVCINIT  JOB MSGLEVEL=1,TIME=1440
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(4)'
//STEPLIB  DD  DSN=SOME.APF.AUTHORIZED.DATASET,
//             DISP=SHR
//DFSRESLB DD  DSN=SOME.IMS.SDFSRESL,
//             DISP=SHR
```

Figure 81. Example for Replacing DBRC Type 4 SVC

```
//SVCINIT  JOB MSGLEVEL=1,TIME=1440
//STEP001 EXEC PGM=DFSUSVC0,PARM='SVCTYPE=(2,4)'
//STEPLIB  DD  DSN=SOME.APF.AUTHORIZED.DATASET,
//             DISP=SHR
//DFSRESLB DD  DSN=SOME.IMS.SDFSRESL,
//             DISP=SHR
```

Figure 82. Example for Replacing Both SVC Modules

Chapter 9. Log Archive Utility (DFSUARC0)

You can use the Log Archive utility (DFSUARC0) to produce an SLDS from a filled OLDS or a batch IMS SLDS. The utility runs as a z/OS batch job, and multiple log archive utility jobs can execute concurrently. When dual output is requested, the SLDS consists of primary and secondary data sets.

The following topics provide additional information:

OLDS Archive

The online IMS system writes log records to an OLDS in a wraparound fashion. When an OLDS is filled, it can be copied to an SLDS using the Log Archive utility. The SLDS can be on DASD or tape.

IMS notifies DBRC whenever an OLDS is either filled or closed or both. DBRC updates the RECON data set to indicate that the OLDS is available to be archived.

Using the Log Archive utility, you can archive multiple OLDSs to a single SLDS as long as the OLDSs being archived were created consecutively by IMS. The JCL supplied to the utility defines which and how many OLDSs are to be archived. The GENJCL facility of DBRC allows you to specify:

- Which OLDSs should be included in the created JCL
- That all OLDSs not yet archived should be included

If all the specified OLDSs are archived successfully, DBRC updates the RECON data set to indicate that the OLDSs are now available for reuse by the online system. If the Log Archive utility job fails, re-run it.

If you do not specify automatic archiving, you must create the JCL to run the utility. If you specified automatic archiving, IMS calls the DBRC GENJCL function to generate JCL for the utility when the specified number of OLDSs has been filled or closed.

If the DBRC JCLOUT DD statement for the GENJCL output is directed to the internal reader, the archive jobs are automatically started. Figure 83 on page 250 shows an overview of the Log Archive utility.

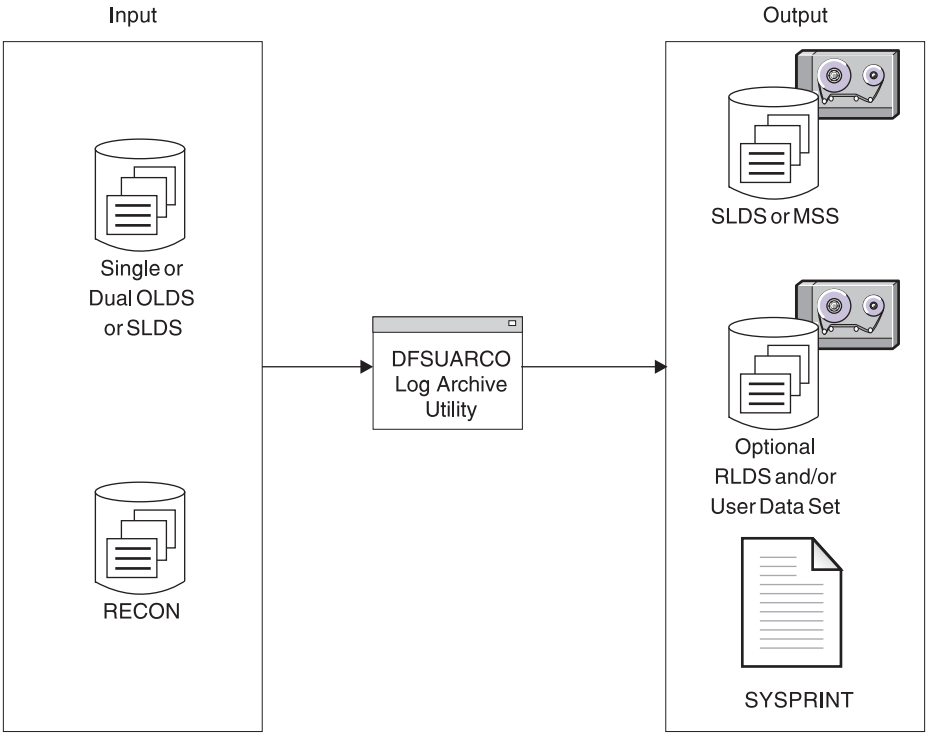


Figure 83. Overview of the Log Archive Utility

Related Reading: For more information on the `GENJCL.ARCHIVE` command, see *IMS Version 9: Database Recovery Control (DBRC) Guide and Reference*.

Batch DASD Log Data Set Archive

IMS DB writes log records on an SLDS that can be on tape or DASD. This allows an IMS batch user to log to DASD, create an SLDS, and later copy that SLDS to DASD or tape. The input data set can be either single or dual. When the input is from a DASD SLDS created with DBRC present, the Log Archive utility will notify DBRC to update the existing SLDS record with the new SLDS information. You must create the JCL for the archive job of a batch SLDS.

Optional Functions for DFSUARC0

The Log Archive utility provides the following optional functions. You must specify these functions with utility control statements.

Creating an RLDS (Recovery Log Data Set)

You can request creation of an output data set containing all the log records needed for DB recovery. The output data set is referred to as a recovery log data set (RLDS). If the input data set contains records for DB recovery, the RLDS is known to DBRC and is used in place of the SLDS by GENJCL when creating JCL for DB recovery and change accumulation. If the input data set contains no records needed for DB recovery, the RLDS is a null data set. In this case DBRC records the data set name and volume serial number of the SLDS, in place of the RLDS DSNAME and volume serial number, and then uses the SLDS for GENJCL instead of the null RLDS.

Omitting Log Records on SLDS

Generally, the SLDS should contain all the log records from the OLDS, but if you need to omit some types of log records from the SLDS, these log records must be specified in an SLDS control statement, using the NOLOG parameter. The SLDS must contain those records that might be needed for database recovery and IMS restart. The Log Archive utility will issue an error message and terminate if a required record type is specified to be omitted.

Copying Log Records into User Data Sets

The Log Archive utility can copy selected log records into multiple user data sets directly. In SYSIN control statements, you can specify the log records to be selected and the ddname of the data set to which the records are to be written.

Specifying User Exit Routines

You can specify multiple user exit routines for the archive utility. The Log Archive utility passes control to each user exit routine at initialization, input log read, and termination time. User exit routines can process the log records or create a data set.

Specifying Forced End of Volume (EOV)

To ensure that corresponding volumes in a dual SLDS on tape contain the same records (and consequently are interchangeable), the number of blocks to be written on a volume can be specified. EOV will be forced to both SLDSs when the specified number of log blocks have been written.

Input for DFSUARC0

The Log Archive utility has two types of input: OLDS and SLDS. The utility only accepts log data sets created by the same release of IMS as the utility release level.

OLDS Input

The OLDS used for input must have been successfully closed. The status in RECON for the input OLDS must be 'ARCHIVE NEEDED'.

An error in a single OLDS causes the archive job to terminate. Run the Log Recovery utility to recover the OLDS, and rerun the Log Archive utility.

If dual OLDSs were used during IMS online execution, both are used as input to the Log Archive utility. If an error is encountered in the primary OLDS, the archive utility switches to the secondary OLDS. If the record is found in the secondary OLDS, the archive job continues. If an error is encountered in the same block, the archive job terminates. Run the Log Recovery utility to recover the OLDS, and rerun the Log Archive utility. If one dual OLDS is not available, for example the status is not 'ARCHIVE NEEDED', only the available OLDS is used as input. The unavailable OLDS is ignored.

If dual OLDSs are used as input and an error exists in the first block of the primary OLDS, the Log Archive utility terminates unsuccessfully. Sequence errors are indicated on the first block of both OLDSs, even though the secondary OLDS might be correct. The Log Archive utility uses the first block of the primary OLDS as an anchoring point. If this block is in error, data collected from it cannot be verified by

comparison to the secondary OLDS. If errors exist on the first block of either OLDS, run the Log Recovery utility to recover the OLDS, then rerun the Log Archive utility.

If multiple OLDSs are specified as the input OLDS, they must have been created consecutively. OLDSs created by different IMS system executions cannot be input at one time.

If any OLDS in the input was terminated at a recovery point (a recovery point results at every /DBRECOVERY and /DBDUMP command that forces an OLDS switch), the archive utility performs as follows:

- If at least one of the SLDSs and RLDSs is placed on DASD, the output data sets are closed and the archive job terminates after processing any OLDS that terminates at a recovery point. Remaining OLDS that might not have been processed are still in a state of ARCHIVE NEEDED.
- If all SLDSs and RLDSs are placed on tape, IMS forces end of volume for all SLDSs and RLDSs and the archive job continues using the next volume for the SLDS and RLDS.

DBRC verifies the input OLDS. If there is an error in the OLDS specifications, the Log Archive utility terminates with an error message.

SLDS Input

The SLDS used for input is the SLDS on DASD created in an IMS batch environment. Also, this SLDS must have closed successfully. When DBRC=NO is specified in the EXEC parameter, tape SLDS input is permitted. You can use the SLDS of a previous archive and archive it again; however, this is not an intended use.

Dual SLDSs can be used as input. If an error is encountered in the primary SLDS, the Log Archive utility switches to the secondary SLDS. If the record is found on the secondary SLDS, the archive job continues. An error in a single SLDS or errors in the same block in dual SLDSs terminates the archive job. Run the Log Recovery utility to recover the SLDS and rerun the Log Archive utility.

Output for DFSUARC0

In addition to the SLDS, the optional RLDS, and the user data set produced as output, the Log Archive utility also produces a listing in SYSPRINT. SYSPRINT contains the following:

- A listing of control statements
- A listing of checkpoint time stamp IDs
- A listing of descriptive messages
- A listing of the result of the archive

Figure 84 on page 253 is an example of a SYSPRINT listing of control statements.

```
********LOG ARCHIVE UTILITY CONTROL STATEMENT********
SLDS -
   NOLOG(10,16,5F,67,69) FEOV(08000)
COPY  DDNOUT1(DATASET1) -
  RECORD(OFFSET(5) FLDTYP(X) VALUE(16) FLDLEN(1) COND(E)) -
  RECORD(OFFSET(5) FLDTYP(X) VALUE(50) FLDLEN(1) COND(E)) -
  RECORD(OFFSET(5) FLDTYP(X) VALUE(51) FLDLEN(1) COND(E)) -
  RECORD(OFFSET(5) FLDTYP(X) VALUE(52) FLDLEN(1) COND(E))
EXIT  NAME(UEXIT01)
```

Figure 84. SYSPRINT Listing of Control Statements

Figure 85 is an example of a listing of checkpoint time stamp IDs.

```
  USER CHECKPOINT RECORD - yyyy.ddd hh:mm:ss.t CHKPT-id region-id prg-name (v1)(v2)
SYSTEM CHECKPOINT RECORD - yyyy.ddd hh:mm:ss.t chkpt-id (v1)(v2) CHECKPOINT XXX  (RESTART TTT)
```

Figure 85. SYSPRINT Listing of Checkpoint Log Records

When checkpoint log records (X'18' and X'4001') are found, the SYSPRINT listing prints one of the preceding output lines. Date, time, and checkpoint ID are shown for both. Region-ID and program name are for X'18' records; checkpoint request type is for X'4001' records, where XXX is the type of checkpoint requested in English. Also shown is the volume serial of the output primary SLDS volume (v1) and, if dual output, the secondary SLDS volume (v2) to which the checkpoint is copied. Restart type is also given for the first X'4001' record where TTT is the type of restart performed in English.

Figure 86 is an example of a SYSPRINT listing of descriptive messages.

```
*** END OF VOLUME FORCED ON SLDS. PRIMARY(volser) SECONDARY(volser) ***
*** WRITE ERROR ON SLDS|USER|RLDS ddname ***
*** OUT-OF-SPACE on SLDS|USER|RLDS ddname ***
*** NO RECORD FOUND FOR SLDS|USER|RLDS ddname ***
```

Figure 86. SYSPRINT Listing of Descriptive Messages

Figure 87 on page 254 shows an example of a SYSPRINT listing of the result of the archive.

```
*** LOG ARCHIVE UTILITY (DFSUARC0)                **hh:mm yy.ddd **
       COPIED LOG RECORDS

FROM     DDNAME=ddname VOLSER=volser          DDNAME=ddname VOLSER=volser
           (for primary input)                    (for secondary input)
                 .
                 .       .
TO PRIMARY SLDS DSNAME=dsname
    VOLSER =   volser  volser  volser .............
TO SECONDARY SLDS DSNAME=dsname
    VOLSER =   volser  volser  volser .............

SLDS DOES NOT CONTAIN THE FOLLOWING LOG RECORDS:
  'xx' 'xx' 'xx' 'xx' ......

TO PRIMARY RLDS   DSNAME=dsname
     VOLSER =   volser  volser  volser .............
TO SECONDARY RLDS DSNAME=dsname
     VOLSER =   volser  volser  volser .............
```

Figure 87. Listing of the Result of the Archive

JCL Requirements for DFSUARC0

The Log Archive utility executes as a standard z/OS job.

Requirement: A job statement, an EXEC statement, and DD statements that define input and output are required.

EXEC

Defines the utility to be run and optional execution parameters. Its format is:

```
//STEP EXEC PGM=DFSUARC0
            PARM= 'nnnn, DBRC=nnn, IMSPLEX=imsplex_name'
```

PARM=

Indicates the subsystem identifier and whether DBRC is specified.

nnnn

Indicates a 1- to 4-character IMS subsystem identifier and must be specified if the input data set is an OLDS. This is the same value as the IMSID for the online IMS system that created the data in the OLDS.

DBRC=YES|NO

DBRC=NO (or N) can be specified to explicitly declare that DBRC **is not** to be used for this execution of this utility.

DBRC=YES (or Y) can be specified to explicitly declare that DBRC **is** to be used for the execution of this utility.

If DBRC= is not specified, YES is the default.

IMSPLEX=*imsplex_name*

Indicates which IMSplex DBRC should join. IMSPLEX= is an optional parameter. See *IMS Version 9: Database Recovery Control (DBRC) Guide and Reference* for detailed information about the IMSPLEX parameter.

DD Statements

STEPLIB DD

Points to the program libraries that contains the Log Archive program and to any user exit routines.

DFSOLPnn DD (for primary OLDS)
DFSOLSnn DD (for secondary OLDS)
Describes the OLDS used for input. You can specify dual OLDSs. In the case of dual OLDSs, the suffixes of the primary and secondary OLDS must match. The value of *nn* (the suffix) is 00 through 99 and must be the same *ddname* that was used when the log data was created by online execution. All OLDSs used as input must have been used consecutively during an online execution but they can be specified in any sequence in the DD statements. You can specify between 2 and 99 read buffers for the DCB BUFNO keyword.

DFSSLDSP DD (for primary input SLDS)
DFSSLDSS DD (for secondary input SLDS)
Specifies the batch SLDS. Optionally, you can specify a dual SLDS for a batch SLDS. A SLDS and an OLDS used for input are mutually exclusive. You can specify 2 through 99 read buffers.

DFSSLOGP DD (for primary output SLDS)
DFSSLOGS DD (for secondary output SLDS)
Defines the SLDS used for output. Its format will depend on the device type used. If the SLDS is on DASD, you must allocate sufficient space to contain the log being archived. The SLDS block size can be specified and can be different from the input data set block size. If not specified, the block size of the input data set is used. The secondary SLDS is optional and specifies dual archiving. If the input is a batch SLDS and the Log Archive utility is run with DBRC present, dual output can be created only if dual SLDS records are already known to DBRC.

If dual SLDSs are being created, they can have different block sizes. However, if FEOV is specified, it is ignored unless the block size of both data sets are equal and both are allocated to tape. If tape is specified, it must have a standard label. You can specify 2 through 99 write buffers.

Restriction: Do not use the JCL parameter FREE=CLOSE on these DD statements. The data sets are dynamically deallocated, and using FREE=CLOSE can produce unpredictable results.

ddname DD (for either RLDS or user output data set, or both)
Defines either a user data set or recovery log data set (RLDS) or both. If the data set is on DASD, you must allocate sufficient space to contain the records being copied to it. The data set is created with RECFM=VB. The block size can be specified and can be different from the block size of the input data set, but it must be large enough to contain your longest record. If not specified, the block size of the input data set is used. If dual data sets are being created, they can have different block sizes. You can specify 2 through 99 write buffers.

SYSPRINT
Defines the output message data set.

SYSUDUMP
Defines the dump data set.

SYSIN DD
Specifies the control statements.

RECON1 DD
Defines the first DBRC (Database Recovery Control) RECON data set. This RECON1 data set must be the same RECON1 data set used by the IMS control region.

RECON2 DD
Defines the second DBRC RECON data set. This RECON2 data set must be the same RECON2 data set used by the IMS control region.

RECON3 DD
Defines the optional DBRC RECON data set used when an error is encountered in RECON1 or RECON2. This RECON3 data set must be the same RECON3 data set used by the IMS control region.

Do not use these RECON data set *ddnames* if you are using dynamic allocation.

Utility Control Statements for DFSUARC0

All control statements are optional. Use the control statements when:

- Using user exit routines
- Creating an RLDS
- Placing certain records into a user data set
- Eliminating certain records from being copied to the SLDS
- Forcing duplicate tape output volumes

There are three types of control statements, and each statement consists of an operation code and parameters. The rules for using the control statement are:

- Control statements can be placed in columns 1 to 72 in free format. Parameters can be in any sequence.
- Each operation code and parameter must be separated with a blank, a comma, or a comment.
- Multiple lines can be used for a control statement. Continuation characters (+ and –) can be placed between columns 1 and 72. If (+) is used, the lines are concatenated without a blank. If (–) is used, the lines are concatenated with a blank.
- The value of any parameter must be specified between single parentheses.

SLDS Statement

An SLDS statement specifies log record types that are not written to the SLDS. It also specifies that end-of-volume is forced for tape output volumes. If omitted, all log records are copied to the SLDS. Only one SLDS control statement is allowed.

The format of the SLDS control statement is:

NOLOG
Defines the log record types that are not to be copied to the SLDS. The value of a NOLOG sub-parameter should be specified in hexadecimal, for example, SLDS NOLOG (19,1A,1B).

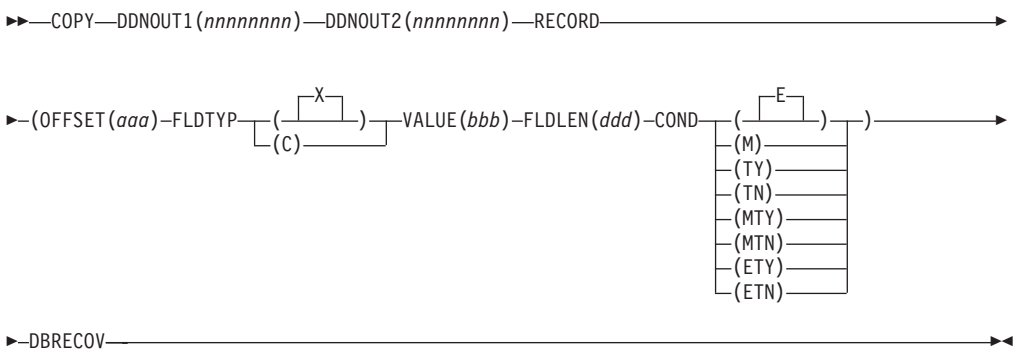
The SLDS must contain those records that might be needed for database recovery and for system restart. The Log Archive utility issues an error message and terminates if a required record type is specified to be omitted.

FEOV
Specifies duplicate output tape volumes. This parameter is only applicable in a dual tape SLDS environment. It ensures that corresponding volumes in a multivolume data set contain the same records (and consequently are interchangeable).

nnnnn indicates the number of blocks to be written to a tape SLDS. Each time the blocks are written, a FEOV is issued for both the primary and secondary SLDSs. The block number is specified in 5 decimal digits. If the block sizes of both SLDSs are not equal, the FEOV parameter is ignored.

COPY Statement

The COPY statement is used to create an RLDS or a user data set during archive. The format for the COPY statement is:



The following abbreviations can be used in place of the keywords in the COPY statement:

Keyword	Abbreviation
OFFSET	O
FLDTYP	T
VALUE	V
FLDLEN	L
COND	C

DDNOUT1
DDNOUT2
Identifies the ddnames of the data sets. DDNOUT2 only applies if dual copies are being created. The DD statements must be included in the JCL. *nnnnnnnn* is a ddname value.

RECORD
Identifies the conditions for selecting a record to be written to the specified data set.

OFFSET(*aaa*)
Defines the beginning of the field to be tested in the record. The default is position one of the record.

aaa is the value and can be in the range from 1 up to and including the length of the record under test. Maximum value is 32767 bytes. No

checking is performed to determine if the logical record length is exceeded. The value specified in the OFFSET keyword is always expressed as relative to byte 1.

FLDTYP(X)|(C)
Defines the type of data in the VALUE field. A value of X or C must be specified.

X defines the data to be treated as hexadecimal character pairs. The test data is packed, two bytes into one, to form hexadecimal equivalents. X is the default.

C defines the data to be treated as EBCDIC.

VALUE(*bbb*)
Can be specified in hexadecimal with X or in EBCDIC with C. The value is specified between quotation marks in EBCDIC. The quotation mark notation is required when the character string contains a separator of blank or comma. Any characters can be specified within the quotation marks. (Double quotation marks within quotation marks represent a single quotation mark.) If a minus sign is the last nonblank character, it is assumed that the value is continued on the next line.

Restriction: The value of *bbb* cannot exceed 255 EBCDIC or 510 hexadecimal characters.

The length of this field is determined by the FLDLEN value and not by the number of "nonnull" characters in this field.

FLDLEN(*ddd*)
Defines the number of characters to be used from the test field.

ddd represents the actual number of bytes to be used, not the number of characters specified in VALUE. The acceptable range of values for this field is 1 to and including 255. The default is 1.

COND(*x*)
Defines the type of test and its relationship to other tests in the group. The default is COND(E).

E Marks the last (or only) element in a test series. Any record control statements appearing after this form a new series of tests. This allows various tests to be performed on each record and each test series can be used on different fields within the record.

M Indicates this is a multifield test; more than one test is to be made on each input record. All tests in this series must be satisfied before final output selection and processing of this record can begin.

T Causes the VALUE byte to be used as a "test under mask" value, instead of a compare field. Only the first byte (two hexadecimal characters if FLDTYP(X)) of the VALUE field will be used. If FLDTYP(C) is used, the hexadecimal equivalent of the EBCDIC character is the test value. If this parameter is used, the FLDLEN keyword must not be specified and a default length of one is assumed.

Y Indicates that there must be a bit in the record test field for each corresponding bit of the test byte for the "test under mask." This is equivalent to a "branch if ones" test.

N Indicates that there must not be a bit in the record test field for any of the corresponding bits of the test byte for the "test under mask." This is equivalent to a "branch if zeros" test.

MT
Defines a “test under mask” option with the properties of a multifield test. This parameter must be used for a multifield test that starts with a “test under mask” value.

ET
Signifies that a multifield test series ends with a “test under mask” condition.

DBRECOV
Copies all log records needed for database recovery to the specified output data set. This output data set is known to DBRC and is used by the GENJCL process in lieu of the created SLDS when creating JCL for DB Recovery or Change Accumulation. This output data set is the recovery log data set (RLDS). If there are no records needed for DB recovery, the RLDS is a null data set. In this case DBRC records the DSNAME and volume serial number of the SLDS, in place of the RLDS DSNAME and volume serial number, and uses the SLDS for GENJCL, instead of the null RLDS.

DDNOUT1 is a required parameter on a COPY control statement. You can specify as many RECORD parameters as needed in a COPY control statement. If no RECORD parameter is specified, all log records are copied to the specified data set. On a given COPY statement, the RECORD parameter and the DBRECOV parameter are mutually exclusive. You can specify multiple COPY control statements, but only one COPY statement with the DBRECOV parameter is allowed. Two COPY statements must not specify the same output data set.

EXIT Statement

An EXIT statement specifies that a user exit routine is to be used.

The format of the EXIT statement is:

NAME*(nnnnnnnn)*
Specifies the member name of the user exit. The user exit routine is accessed with a LOAD from the archive utility program; preferably link-edited into either JOBLIB or STEPLIB.

You can specify multiple EXIT control statements or multiple NAME parameters.

Error Processing for DFSUARC0

The Log Archive utility provides the following return codes:

Code	Meaning
0	Archive processing completed successfully.
4	This return code is issued if one or both of the following events occur: • Archive processing completed successfully, but not all OLDS were archived. A recovery point was encountered and end of job was forced. Rerun the Log Archive utility for the remaining unarchived OLDS. See SYSPRINT messages. • An OLDS specified as input to the archive utility was already archived when this job ran. The SYSPRINT messages identify the OLDS that were already archived.

8 Archive processing completed unsuccessfully. Messages DFS3263I or DFS3062I indicate the reason.

U3274 ABEND—DBRC internal failure. Message DFS3274I plus various DSPxxxxx messages indicate the reason.

Related Reading: Refer to *IMS Version 9: Messages and Codes, Volume 1* for descriptions of all error messages issued by DFSUARC0.

Examples of DFSUARC0

Example 1

The following example shows the JCL for the Log Archive utility using the COPY control statement to create an RLDS:

```
//ARCHIVE  JOB MSGCLASS=A,CLASS=A,MSGLEVEL=(1,1)
//*
//ARC1    EXEC PGM=DFSUARC0,PARM='SYSA'
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
/*   COPY FROM 3 OLDS TO A SLDS                          */
/*   RLDS AND A USER DATA SET ARE ALSO CREATED           */
//DFSOLP00  DD DSN=OLP900,DISP=SHR,DCB=(BUFNO=20)
//DFSOLP01  DD DSN=OLP901,DISP=SHR,DCB=(BUFNO=20)
//DFSOLP02  DD DSN=OLP902,DISP=SHR
//DFSSLOGP  DD DSN=SLDSP.D82001.N001,DISP=(,KEEP),
//             UNIT=TAPE,VOL=(,,,99),LABEL=(,SL)
//RLDSDD1   DD DSN=RLDSP.D82001.N001,DISP=(,KEEP),
//             UNIT=TAPE,VOL=(,,,99),LABEL=(,SL)
//USERDD1   DD DSN=USER.D82001.N001,DISP=(,KEEP),
//             UNIT=3350,VOL=USER01,SPACE=(CYL,5)
//RECON1    DD DSN=RECON1,DISP=SHR
//RECON2    DD DSN=RECON2,DISP=SHR
//RECON3    DD DSN=RECON3,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUDUMP  DD SYSOUT=A
//SYSIN     DD *
 COPY DDNOUT1 (RLDSDD1) DBRECOV
 /*  THIS USER DATA SET CONTAINS                         */
 /*  X'A5', X'A6', AND X'A7' LOG RECORDS                 */
 COPY DDNOUT1 (USERDD1) -
  RECORD (O(5) T(X) V(A5) L(1) C(E)) -
  RECORD (O(5) T(X) V(A6) L(1) C(E)) -
  RECORD (O(5) T(X) V(A7) L(1) C(E))
 EXIT NAME (UEXIT01)
```

Example 2

The following example shows the JCL for the Log Archive utility using FEOV to ensure consistency in the SLDS.

```
//ARCHIVE2 JOB MSGCLASS=A,CLASS=A,MSGLEVEL=(1,1)
//*
//ARC2    EXEC PGM=DFSUARC0,PARM='SYSA'
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//*   COPY FROM 2 OLDS TO DUAL SLDS                    */
//DFSOLP02  DD DSN=OLP902,DISP=SHR
//DFSOLP00  DD DSN=OLP900,DISP=SHR
//DFSOLS00  DD DSN=OLS900,DISP=SHR
//DFSOLS02  DD DSN=OLS902,DISP=SHR
//DFSSLOGP  DD DSN=SLDSP.D82001.N001,DISP=(,KEEP),
//             UNIT=TAPE,VOL=(,,,99),LABEL=(,SL)
//DFSSLOGS  DD DSN=SLDSS.D82001.N001,DISP=(,KEEP),
//             UNIT=TAPE,VOL=(,,,99),LABEL=(,SL)
//RECON1   DD  DSN=RECON1,DISP=SHR
```

```
//RECON2   DD  DSN=RECON2,DISP=SHR
//SYSPRINT DD  SYSOUT=A
//SYSUDUMP DD  SYSOUT=A
//SYSIN    DD  *
  SLDS FEOV (08000)
 /*  THE SLDS ARE FORCED EOV AFTER 8000 LOG BLOCKS    */
 /*  ARE WRITTEN.                                     */
/*
```

Examples

Chapter 10. Log Merge Utility (DFSLTMG0)

The Log Merge utility (DFSLTMG0) produces a data set by merging the system log data sets (SLDS) from two or more IMS systems. The Log Merge utility identifies log records based on a system clock value in the record, then merges them in ascending order. The resulting data set is used as input to the Log Transaction Analysis utility.

The Log Merge utility can merge up to nine IMS system logs. Each log is the output of a uniquely identified IMS system running during the same time span. The order of input to the Log Merge utility is LOG01, LOG02, LOG03, ..., LOG09.

DFSLTMG0 is placed in IMS.SDFSRESL during IMS system definition.

The following topics provide additional information:

- "Restrictions for DFSLTMG0"
- "Input and Output for DFSLTMG0"
- "JCL Requirements for DFSLTMG0" on page 265

Related Reading: You can use Knowledge-Based Log Analysis (KBLA) to build JCL and execute DFSLTMG0. See "Using KBLA to Run a Job Against IMS Log Records" on page 508 for more information.

Restrictions for DFSLTMG0

The Log Merge utility cannot use Common Queue Server (CQS) logs as input because CQS log records have a different format from IMS log records.

Input and Output for DFSLTMG0

The input to the Log Merge utility consists of logs from up to nine separate IMS systems and control statements. A log from any single system can consist of a series of logs concatenated in time sequence. The utility only accepts input log data sets created by the same release of IMS as the utility release level. Log records must be from IMSs that are running on processors with a synchronized external or internal clock to ensure that compatible system clock values between log records are produced. The system clock value, called the time of day (TOD) clock, is an 8–byte field stored at the end of each log record.

DFSLTMG0 produces as output a merged data set of log records made between the times specified with START and STOP control statements. This time is the Universal Time Coordinated (UTC).

Restriction: Do not use merged output as input to the Database Recovery utility.

Controlling the Log Merge

To control the log output:

- Choose logs from the required systems you want to examine when using the Log Transaction Analysis utility.
- Coordinate the series of input logs for each system so they cover a similar time span.

- Specify a start time and stop time for Log Merge utility control statements if you need to sample the cross-system processing for a particular time interval. Other log activity is collected if it falls between the initial and final events present on the first log.
- Specify the control statement with the keyword listed under Log Record Selection to merge only certain types of log records.

Control Statement Format

START

Used to specify a start time. This statement must be present.

Position	Length	Value
1	5	START
6	1	blank
7	Variable	yyddd,hhmmsstt[{+|-}HHMM] where any trailing digits of hhmmsstt can be omitted and the optional time-zone information following hhmmsstt contains: **+ or -** Specifies the sign of the time-zone offset from UTC (Universal Coordinated Time). **HH** Specifies the number of whole hours of offset from UTC. HH can be a numeric value from 0 to 14. **MM** Specifies minutes of offset. MM can be 00, 15, 30, 45, or blank. You only need to specify the optional time-zone information if the offset to UTC on the day entered is different from the current offset, for example due to a daylight saving time change.

STOP

You must specify a stop time, which must be relative to the time field in LOG01.

Position	Length	Value
1	4	STOP
5	1	blank
6	Variable	yyddd,hhmmsstt[{+|-}HHMM] where any trailing digits of hhmmsstt can be omitted and the optional time-zone information following hhmmsstt contains: **+ or -** Specifies the sign of the time-zone offset from UTC. **HH** Specifies the number of whole hours of offset from UTC. HH can be a numeric value from 0 to 14. **MM** Specifies minutes of offset. MM can be 00, 15, 30, 45, or blank. You only need to specify the optional time-zone information if the offset to UTC on the day entered is different from the current offset, for example due to a daylight saving time change.

Log Record Selection

Use this control statement to merge only certain types of log records. The

format is free-form, starting in column 1. Any of the keywords in the following list can be used, in any combination desired, with the following syntax restrictions:

- BLANK, following a keyword terminates processing of this control statement.
- COMMA, following a keyword continues processing of this control statement.

Keyword	Meaning
ALL	All log record types are selected (this is the default if no control statements are present).
MSG	Selects all log records necessary for the Fast Path Log Analysis utility (DFSILTA0); X'01', X'03', X'06', X'07', X'08', X'3x' series, X'40', X'42', X'47'.
3X	Selects all log records within the range; X'30' to X'3F'.
XX	Where XX is the log record type selected.

JCL Requirements for DFSLTMG0

EXEC

Executes the Log Merge utility DFSLTMG0.

```
//STEP0 EXEC PGM=DFSLTMG0
```

DD Statements

STEPLIB DD

Points to IMS.SDFSRESL, which contains the IMS nucleus and required action modules.

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

PRINT DD

Indicates the SYSPRINT data set used for control statements and error messages.

```
//PRINT DD SYSOUT=A
```

LOG01 DD

Describes the first input log data set.

```
//LOG01 DD DSNAME=IMS.LOGA,DISP=OLD,
//         VOL=SER=XXXXXX,UNIT=TAPE
```

LOG02 DD

Describes the second input log data set.

```
//LOG02 DD DSN=IMS.LOGB,DISP=OLD,
//         VOL=SER=XXXXXX,UNIT=TAPE
```

LOGOUT DD

Describes the output data set.

```
//LOGOUT DD DSN=IMS.LOGOUT,DISP=(,PASS),
//          VOL=SER=YYYYYY,UNIT=TAPE,
//          DCB=(RECFM=VBS,LRECL=6000,BLKSIZE=6008)
```

SYSIN DD

Describes the control statement data set.

```
//SYSIN DD *
```

Example: Sample control cards. This example will introduce an error code of 8. This occurs when the release level of the log input does not match the release level of the utility. Message DFS3062I indicates the reason.

```
START 75332,0830
STOP 75332,1030
MSG
```

Chapter 11. Log Recovery Utility (DFSULTR0)

You can use the Log Recovery utility (DFSULTR0) to produce a usable log data set from a log data set that contains read errors or that was not properly terminated. The Log Recovery utility can recover both OLDSs and batch or online SLDSs. In a Remote Site Recovery (RSR) environment, do not use this utility on the tracking subsystem except in CLS mode to close the OLDS from the WADS.

This utility has four modes of operation:

CLS Closes an OLDS from the write-ahead data set (WADS) or from the next OLDS.

CLS mode processes only OLDSs. To close SLDSs, use DUP mode. In CLS mode, a user-written logger exit routine (DFSFLGX0) is invoked during the execution of the Log Recovery utility if the exit routine is present. DFSFLGX0 is called once with an initialization call, once with a write call for each log buffer of data that is written, and once with a termination call.

Related Reading: Refer to *IMS Version 9: Customization Guide* for a description of the Logger exit routine.

DUP Processes either SLDSs or OLDSs. DUP mode creates an interim log containing error ID records, or a closed batch SLDS containing an end-of-file mark.

To safely close an SLDS, run DUP mode, then REP mode. Or, run DUP mode with a non-zero ERRC and the log sequence number (LSN) returned when the original error occurred. The system might issue message DFS616I, which includes the LSN, at the point of failure. If DFS616I is not issued, you must run DUP mode followed by REP mode to safely close an SLDS.

Attention: Do not run DUP mode without an LSN to close SLDSs in a production environment, unless you also run REP mode. Using DUP mode without also using an LSN or REP mode can result in loss of data.

REP Reads the interim log, replaces the error ID records with user-specified data, and creates a new log.

PSB Permits the generation of an “active PSBs” report from a mix of OLDS and SLDS.

In an RSR environment, if you use this utility in any mode other than CLS, you can cause problems that might require you to reinstall the tracking subsystem.

If you lose a log volume on an active subsystem in an RSR environment, you might be able to get a copy from the tracking subsystem. However, consider this only as a last resort because the copy of the records might not be valid.

The valid data set attributes for the input log data set are:

- RECFM=VB
- BLKSIZE greater than 8
- LRECL greater than 4 and less than or equal to BLKSIZE minus 4

The following topics provide additional information:

- “OLDS Recovery” on page 268

Related Reading: You can use KBLA to build JCL and execute DFSULTR0. See "Using KBLA to Run a Job Against IMS Log Records" on page 508 for more information.

OLDS Recovery

An OLDS must be closed before it can be archived or used as input to any utility. The OLDS in use is closed automatically during normal shutdown or during an emergency restart. It must be closed using the Log Recovery utility if an emergency restart cannot close it, or when the OLDS is not closed because a write error is detected.

The Log Recovery utility detects the following types of errors:

- I/O errors while reading the input log data set
- Errors in the log record or log block length
- Sequence errors in the log record, the log block, or the OLDS write time stamp

A stop time of zeros in the RECON indicates that the Log Recovery utility needs to be run in CLS mode. It should be run before DUP if possible; however, it can be run after REP.

SLDS Recovery

An SLDS must be closed before it can be used as input to any utilities or IMS restart. The Log Recovery utility closes an SLDS created by a batch IMS system. The utility detects the following types of errors:

- I/O errors while reading the input log data set
- Errors in the log record or log block length
- Log record sequence errors

Input for DFSULTR0

The Log Recovery utility uses both single and dual logs for input. The utility only accepts input log data sets created by the same release of IMS as the utility release level.

Single Log Input

In CLS mode, the utility:

1. Reads the input log
2. Produces a usable log if no errors are encountered
3. Produces a report of active PSBs when the WADS is used as input

In DUP mode, the utility:

1. Reads the input log
2. Creates a usable log if no errors are encountered
3. Creates an interim log and an error listing if errors are encountered

Using the interim log produced by DUP mode, and in REP mode, the utility:

1. Reads the interim log
2. Copies good blocks to the output log
3. Replaces error blocks with good ones based on user-specified control statements
4. Produces a usable log

In PSB mode, the utility:

1. Reads the input log
2. Produces a report of active PSBs

Dual Log Input

In the following discussion, the terms “primary” and “secondary” are used to identify the two logs of a dual log data set.

In CLS mode, the utility:

1. Reads the input logs.
2. Produces a usable log if no errors are encountered at the same point on both OLDS. If an error is encountered on one OLDS but not the other, an error listing with an error block ID of NONE is produced and the utility continues processing. In this case, the OLDS pair produced may be usable as input to an IMS restart or archive (which also tolerate errors on only one of a pair of OLDS), but DUP mode processing is needed to remove the errors.
3. Produces a report of active PSBs when the WADS is used as input.

In DUP mode, the utility:

1. Reads the primary log and copies the contents to a new system log. If it encounters an error block, DUP mode positions a read operation on the secondary log where the log error was encountered. DUP mode then reads the secondary log and copies the contents to the same new system log. If an error is now encountered on the secondary log (but not at the same position), DUP mode positions a read operation on the primary log where the error was encountered. This process continues until a complete new system log is produced. Figure 88 on page 270 illustrates DUP mode and REP mode using dual logging.

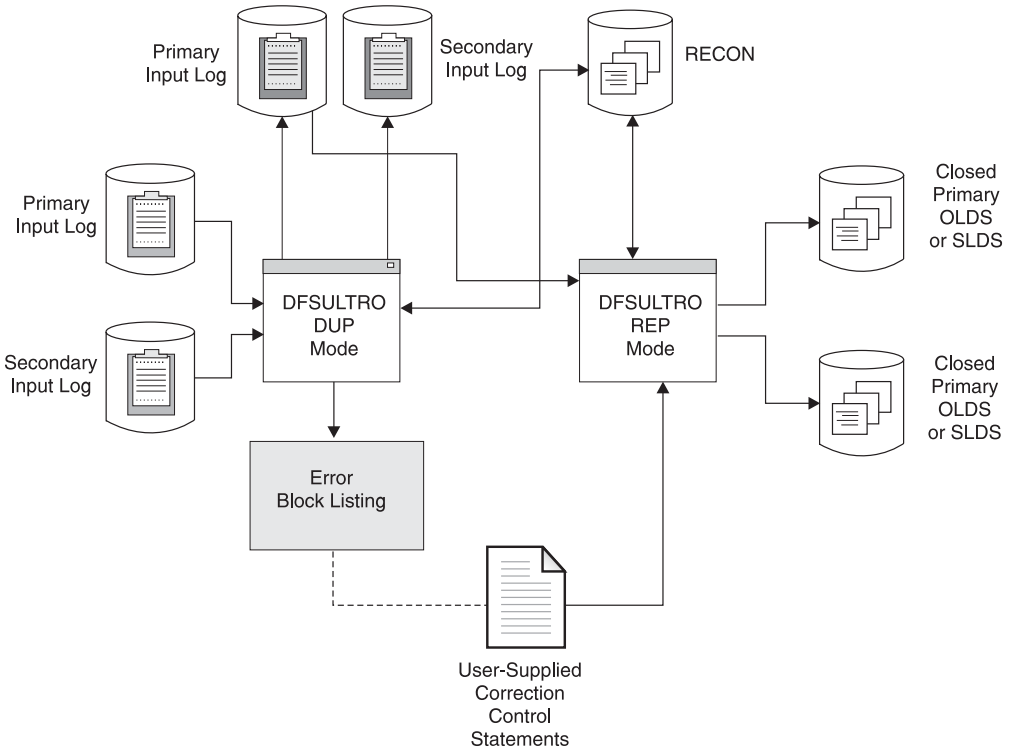


Figure 88. DUP Mode and REP Mode When Dual Logging Is Used

2. Copies both error blocks onto the interim log and uniquely identifies the error blocks when it encounters an error on both logs in the same position. The interim log data set contains all valid log blocks, error blocks, and error ID records.
3. Produces a character and hexadecimal listing of the error blocks to be used as a guide for creating the user-specified control statements required by REP mode.

Using dual logs for input, REP mode:

1. Reads the interim log created by DUP mode
2. Copies good blocks
3. Replaces error blocks with good ones based on control statements
4. Produces a usable log

If dual system log input is used and errors at the same position on both input logs are not encountered, the log produced by DUP mode is correct and REP mode is not required.

Output for DFSULTR0

In addition to the usable log, active PSB report, and the interim log, the Log Recovery utility also produces the following:

- Interim Log Error ID Record
- Error Block Listing (SYSPRINT)
- REP mode verification messages
- Dump of data record

Interim Log Error ID Record

Figure 89 illustrates the error ID record on the interim log produced from dual log input. In this example, BLK2 of both the primary and secondary logs has errors. On the interim log, the first error ID is for BLK2B and the second error ID is for BLK2A. During REP mode, BLK2A or BLK2B is replaced with a good block based on control statements. This example also shows the valid log after REP mode execution.

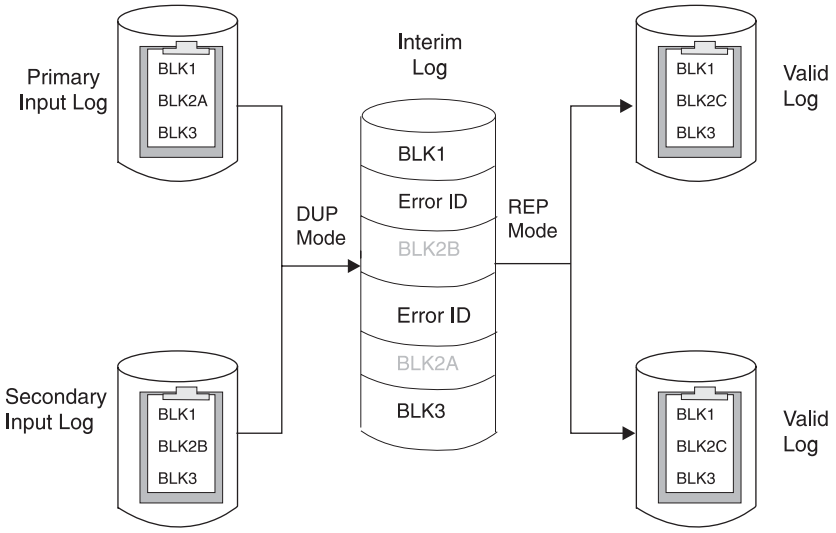


Figure 89. Error ID Records On An Interim Log

Error Block Listing (SYSPRINT)

The error block listing contains the errors found during execution of CLS mode and DUP mode. It also contains verification messages resulting from REP mode followed by a dump of the data record.

CLS Mode and DUP Mode Error Listing

```
ppppppppppppppppppppp ON ddddddddd BLOCK# bbbbbbb ** ERROR-ID=xnnnnn **
sssssssssssssssssss--gghhiijj
```

The fields of the error block listing are:

ppppppppppppppppppppp
Is a message prefix which identifies the type of error. The following types of errors are identified:

PERMANENT I/O ERROR
The SYNAD exit for the input log was entered with an error other than a data check or a length error or consecutive data checks occurred.

DATA CHECK
The SYNAD exit for the input log was entered with a data check error.

END-OF-DATA
The EODAD exit for the input log was entered. This is not an error but rather an indication that processing for this input data set has ended. If the swap to the alternate log is successful, processing will continue on the alternate log.

BLOCK LENGTH ERROR
The length in the block descriptor word (BDW) is not valid.

BLOCK TOD ERROR
The time-of-day (TOD) in the OLDS block suffix is not in ascending order.

BLOCK SEQ ERROR
The block sequence number in the OLDS block suffix is not in ascending order.

RECORD LENGTH ERROR
The length in a record RDW is not valid.

RECORD SEQ ERROR
The record sequence number is not in ascending order.

ddddddddd
Is the ddname of the data set where the error is encountered. The following list shows possible ddnames:

IEFRDER
The primary input SLDS.

IEFRDER2
The secondary input SLDS.

DFSOLP
The primary input OLDS.

DFSOLS
The secondary input OLDS.

bbbbbbb
Is the relative block number (in hexadecimal) of the block in error. Blocks are counted beginning with the first block of the first input volume, starting with 0000001.

x Is either an A or a B and identifies whether the error occurred on the current log or the alternate log. When processing begins, the primary log is the current log and the secondary log is the alternate log. If processing swaps to the alternate because of an error, these roles reverse and processing continues. Errors on the alternate log are always reported before errors on the current log.

nnnnn
Is a sequential number which identifies the error.

xnnnnn is 'NONE ' when CLS mode processing on dual OLDS encounters an error on one OLDS but not on the other at some point. The reason for the error listing under these conditions is to alert you to a situation where you might want to use DUP mode to fix the errors even though the OLDS may be usable for restart or archive without doing so.

sssssssssssssssssss
Is a message suffix which further identifies the error. This suffix can be:

ORIGINAL BDW X'ssss'
The original block length in the BDW is not correct and has been changed. The variable *ssss* is the original value expressed in hexadecimal notation.

RCD AT OFFST X'oooo'
A log record has an invalid length in the record descriptor word (RDW). The variable *oooo* is the offset (relative to zero), in hexadecimal, from the beginning of the block to the RDW in error.

ffffffff TO ttttttt
A block sequence, block TOD, or record sequence error has occurred. The variable *ffffffff* is the last good value (or assumed good value). The variable

ttttttt is the value in error. After a sequence error occurs, the block sequence number, the block TOD, and the first record sequence number in the next block are assumed to be good, and thus begin a new sequence on which the remaining records will be checked. The Log Recovery utility reports breaks in sequences of good data. You must analyze the reports and determine what is valid data and what is invalid data.

gg Is either blank or NS. This is the first of several special suffix values. NS applies only with dual SLDS input. The two input logs do not start with the same block. It is not possible to swap to the 'alternate' log (or write to the corresponding output data set) until the first block common to both input logs is read.

hh Is either blank or CE. This is the second of the special suffix values. CE indicates that this is a consecutive error. A second through nth error has occurred without reading an intervening good block.

ii Is either blank or SA. This is the third of the special suffix values. SA indicates that it is not possible to swap to the alternate log because the alternate log has already either reached END-OF-DATA or encountered a PERMANENT I/O ERROR.

jj Is either blank or SO. This is the last of the special suffix values. SO indicates that during a swap to the alternate log the alternate log has either reached END-OF-DATA or encountered a PERMANENT I/O ERROR. In this case processing would normally return to the original current log. However, the current log has already reached END-OF-DATA or encountered a PERMANENT I/O ERROR. Therefore it is not possible to return to the current log.

REP Mode Verification Messages

During REP mode processing, a valid replacement of data on the interim log data set causes the following message to be printed:

```
DATA REPLACED IN RECORD Axxxxx ... replacement data text...
```

where xxxxx is the error ID.

An error in the control statement format causes the following message to be printed:

```
ERROR IN CONTROL STATEMENT FORMAT ... text of control statement...
```

Dump of Data Record

The dump of the data record following the verification messages is a hexadecimal representation of the record. The hexadecimal representation is printed in four lines per print line of the data record.

- The first line consists of the position within the block in error (starting with 1), and the EBCDIC representation of the bytes.
- The second line indicates the first byte of each log record, using an asterisk.
- The third line consists of the zone half representation.
- The fourth line consists of the digit half representation.

The format of the printed output is shown in Figure 90 on page 274.

```
000001            q    RRE   b       // EBCDIC representation
        *                          // first byte of a log record
     2000020049  00DDC40809        // high-order hexadecimal digit
     00000D0008  029954024F        // low-order hexadecimal digit
```

Figure 90. Dump of Log Recovery Data Record

Active Region Messages

When WADS is specified in CLS mode, the active PSBs at the time of the system failure are printed. A line is printed for each PSB active at the time of failure. If backout is required for the PSB, database names are listed under the PSB line in the output. The format of this output is shown in Figure 91.

```
***************** RECOVERY REQUIREMENTS **********************

PSB NAME   RECOVERY TOKEN              DATABASE   DSID   ACTION Required
PPPPPPPP
           EEEEEEEEHHHHHHHHHHHHHHHH

                                       DDDDDDDD    NNN    MMMMMMMM
                                       SSSSSSSS


END OF REPORT
```

Figure 91. Active Region Report

The fields in the report have the following meanings:

PPPPPPPP The PSB name.

EEEEEEEE The EBCDIC portion of the recovery token.

HHHHHHHHHHHHHHHH The hexadecimal portion of the recovery token for eight bytes (16 characters).

DDDDDDDD The database name.

SSSSSSSS The database name status. If no database names are in the DDDDDDDD field, one of the following messages appears:

- No database names found
- DBNAME list incomplete

NNN The Fast Path data set ID number that indicates the area data set.

MMMMMMMM The message issued. One of the following messages is issued:

- Backout is required
- Redo is required
- Databases are in doubt

The Active-Region report is also produced in PSB mode.

JCL Requirements for DFSULTR0

The following JCL is required to run DFSULTR0. Examples of JCL using different modes appear in “Examples of DFSULTR0” on page 281.

EXEC

Invokes the Log Recovery utility (DFSULTR0). The format must be:

```
//STEP EXEC PGM=DFSULTR0,PARM='IMSID=iiiiiiii,
//             DBRC=ddd, IMSPLEX=imsplex_name'
```

IMSID=*iiiiiiii*

Indicates the IMSID of the on-line system that created the input OLDS.

Requirement: IMSID= is required for CLS mode. IMSID= is required for DUP mode with OLDS input and DBRC=YES (specified or defaulted).

IMSID= is ignored if it is specified but not needed.

DBRC=YES|NO

Indicates that the DBRC= default **is not** established by the IMSCTRL macro during IMS system definition.

DBRC=NO (or N) can be specified to explicitly declare that DBRC **is not** to be used for this execution of this utility.

DBRC=YES (or Y) can be specified to explicitly declare that DBRC **is** to be used for this execution of this utility. DBRC=YES is required (and the default) for CLS mode. DBRC=YES is optional for DUP and REP modes.

Recommendation: If DUP mode is run with DBRC active, REP mode should also be run with DBRC active

IMSPLEX=*imsplex_name*

Indicates which IMSplex DBRC should join. IMSPLEX= is an optional parameter. See *IMS Version 9: Database Recovery Control (DBRC) Guide and Reference* for detailed information about the IMSPLEX parameter.

To allow a parameter to default, the complete parameter (including the keyword) must be omitted from the PARM field.

If no input parameters are specified, the default will be IMSID=(not specified) and DBRC=YES.

DD Statements

The DD statements are only used if they are required for a given execution of the Log Recovery utility.

Restriction: The following restrictions apply to the DD statements:

- If single logging is used and DBRC is active, only single logs can be presented as input to the Log Recovery utility and only single logs can be created as output from DUP and REP mode. Otherwise, DBRC abends result.
- If dual logging is used and DBRC is active, only dual logs can be presented as input to the Log Recovery utility (except for PSB mode, which only accepts single log input). Otherwise, incorrect DBRC RECON updates result. If dual logs are presented as input, dual logs must be created as output from DUP and REP mode. You must correctly specify primary and secondary DSNAMEs on the DD statements.
- Specify OLDS input using the DFSOLP (and DFSOLS) DD statement.
- Specify SLDS input using the IEFRDER (and IEFRDER2) DD statement.

- Do not specify DFSOLP (and DFSOLS) DD statements in an execution that also contains an IEFRDER (and IEFRDER2) DD statement.
- Do not specify DFSWADSn DD statements in an execution that also contains a DFSNOLP (and DFSNOLS) DD statement.
- Do not specify DFSWADSn, DFSNOLP (and DFSNOLS), or any combination in an execution that also contains an IEFRDER (and IEFRDER2) DD statement.
- Do not specify DFSPOLP (and DFSPOLS) DD statements in an execution that also contains a DFSNOLP (and DFSNOLS) DD statement.
- Do not specify DFSWADSn DD statements in an execution that also contains the keyword NOWADS.

Refer to the examples at the end of this chapter for valid DD statement combinations.

STEPLIB DD
Points to IMS.SDFSRESL, which contains the Log Recovery utility's modules.

SYSPRINT DD
Defines the system messages data set.

SYSUDUMP DD
Defines the dump data set.

SYSUDUMP statements are not included in the examples at the end of this chapter.

DFSOLP DD
Defines the primary, or only, input OLDS.

DFSOLS DD
Defines the secondary input OLDS. Include this statement only when dual OLDSs are used.

DFSWADS*n* DD
Defines the WADS data set, where *n* can be 0 through 9. All WADSs used during online execution can be specified, but only those in use by the online system at the time of failure are required. This DD statement is required when closing an OLDS from a WADS. If no WADS were in use by the online system, no DFSWADSn DD statements are used.

DFSNOLP DD
Defines the primary, or only, next-OLDS. The next-OLDS is the OLDS written by the online IMS system immediately after the OLDS having a write error.

DFSNOLS DD
Defines the secondary next-OLDS. Include this statement only when dual OLDSs are used.

DFSPOLP DD
Defines the primary OLDS that the IMS online subsystem used before the specified OLDS which is being closed. If there is no prior OLDS, this DD statement should not be used. This DD statement is used only when an OLDS is being closed from the WADS.

DFSPOLS DD
Defines the secondary OLDS that the IMS online subsystem used before the specified OLDS that is being closed. Include this statement only when dual prior OLDS are used.

IEFRDER DD
Defines the primary, or only, input SLDS. All input SLDS logs for DUP mode

should have the same block size. (See “Example 9” on page 285 for multivolume SLDS considerations when running DUP.) IEFRDER is used to specify the concatenation of OLDS and SLDS logs for PSB mode. When specifying a concatenation of logs, the names of the logs must be provided in ascending order.

IEFRDER2 DD
Defines the secondary input SLDS. Include this statement only when dual logs are used. Omit this statement if you do not need the data sets. Do not use DD DUMMY or DSNAME=NULLFILE.

NEWRDER DD
Defines the primary, or only, output data set for the new or interim log.

NEWRDER2 DD
Defines the secondary output data set for the new or interim log. If DBRC is active and dual logs are used as input, this statement is required. If DBRC is not active, this statement is not required. Do not use DD DUMMY or DSNAME=NULLFILE.

RECON1 DD
Defines the first DBRC RECON data set. This statement is not required if dynamic allocation is used.

RECON2 DD
Defines the second DBRC RECON data set. This statement is not required if dynamic allocation is used.

RECON3 DD
Defines the optional DBRC RECON data set used when an error is encountered in RECON1 or RECON2. This RECON data set must be the same RECON data set used by the control region. This statement is not required if dynamic allocation is used.

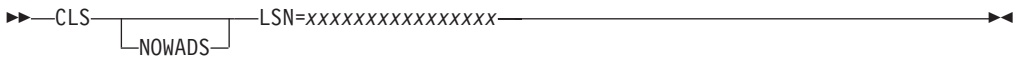
SYSIN DD
Defines the control data set containing the log recovery input control statements.

Utility Control Statements for DFSULTR0

Utility control statements for the Log Recovery utility differ depending on what mode used. This section includes the utility control statements for the CLS mode, DUP mode, REP mode, and PSB mode.

CLS Mode–Close an OLDS from the WADS or NEXT OLDS

The format of this control statement is:



CLS
Indicates CLS mode.

Requirement: DBRC is required for CLS mode.

When closing from the WADS, if a prior OLDS is available, the suffix from the last block written to the prior OLDS (the block sequence number is passed to DBRC at OLDS switch and stored in the RECON) is obtained. The block suffix is used to establish a basis for sequence checking the OLDS being closed.

When closing from the WADS, either EOF or encountering the first error causes an attempt to close the OLDS from the WADS. If a sequence error is found, CLS mode fails. A listing containing the block at the first error is produced (see “Example 1” on page 281).

When closing from the next-OLDS, the sequence number of the first block of the next-OLDS (BSN) is determined. The input OLDS is closed when block BSN-1 is found on the input OLDS. If either EOF or an error is encountered before block BSN-1 is found, CLS mode fails (see “Example 2” on page 281).

NOWADS

Suppresses the use of WADS when closing the OLDS. When this keyword is used, the DFSWADSn DD card must be removed from the JCL. Otherwise, user abend U3271 will result.

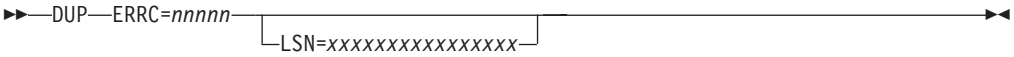
Attention: Use NOWADS only when WADS is unavailable. Do not use this keyword if possible; log records can be lost, data integrity can be compromised, and recovery might not be complete.

LSN=*xxxxxxxxxxxxxxxx*

An optional parameter used in DUP or CLS mode processing to specify a log sequence number that must be encountered on the input log. If the utility would otherwise succeed (return code of 0 or 4) but the last log sequence number encountered is less than xxxxxxxx, the utility ends with a return code of 8, DBRC is not notified of a successful completion, and message DFS3271I is issued. The value of xxxxxxxxxxxxxxxx must be 16 hexadecimal characters.

DUP Mode–Recover an OLDS or SLDS (Create an Interim Log)

The format of this control statement is:



DUP

Indicates DUP mode.

ERRC=*nnnnn*

Is used to terminate DUP mode after a predefined number of I/O or sequence errors are detected on the input log data set. *nnnnn* specifies the number of errors (00000 through 99999). If no value is specified or the keyword is omitted, the default is 99999. This field must contain 5 digits, with leading zeros.

If an *nnnnn* of 00000 is specified, DUP mode is terminated and the interim log is closed when the first error is encountered. The error ID record and error blocks are not written on the interim log. REP mode is not required.

ERRC=00000 is used to close an SLDS without having to run REP mode (see “Example 9” on page 285). A listing can be produced that contains the block at the first error. When the first error is encountered, additional checks are made to ensure that no newer data exists beyond the first error.

Attention: Use caution when running `DUP ERRC=00000` in a production environment. Because these checks are not foolproof, only specify ERRC=00000 if you clearly understand the risks involved: closing the log in the middle of good data, for example, can destroy good data. It is safer to run with a value of *nnnnn* greater than 00000 and to also run REP mode.

If an ERRC value greater than zero is specified, DUP mode is terminated when either EOF is encountered or ERRC is reached (ERRC is tested before each

block read). If errors are found, error ID records and error blocks are written on the interim log and REP mode is required. A listing that contains the errors found is produced.

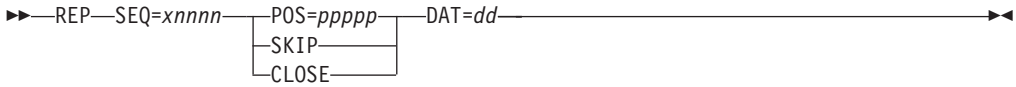
Specify an ERRC value greater than zero when recovering an OLDS or SLDS (see “Example 3” on page 281 and “Example 5” on page 283).

LSN=*xxxxxxxxxxxxxxxx*
An optional parameter used in DUP or CLS mode processing to specify a log sequence number that must be encountered on the input log. If the utility would otherwise succeed (return code of 0 or 4) but the last log sequence number encountered is less than xxxxxxxx, the utility ends with a return code of 8, DBRC is not notified of a successful completion, and message DFS3271I is issued. The value of xxxxxxxxxxxxxxxx must be 16 hexadecimal characters.

REP Mode–Recover an OLDS or SLDS (Create a New Log)

This mode reads the interim log created by DUP mode, copies good blocks, and replaces error blocks with good ones based on the REP control statements. (Only the primary input data set is read during REP mode). The output log data set is a new OLDS or SLDS log. At least one control statement is required but any number can be included (See “Example 4” on page 282 or “Example 6” on page 283).

The format of the control statement is:



REP
Indicates REP mode.

SEQ=*xnnnnn*
Indicates the identification number of the block to be changed. The number is provided in the DUP mode listing output. See “Error Block Listing (SYSPRINT)” on page 271 for a description of the content of the error block listing.

POS=*ppppppp*
Indicates the starting position, relative to 1, of the data being replaced.

SKIP
Indicates the output log will not contain this block of data.

CLOSE
Indicates the output log will be closed immediately before this error block.

The REP mode CLOSE option should not be confused with the process of closing an OLDS from the WADS or next-OLDS using CLS mode.

DAT=*dd*
dd is 2 to 50 hexadecimal characters (0 through 9, A through F) representing the replacement data.

The following rules apply to use of the REP statement:

- At least one control statement must be supplied.
- Unless the log is closed at a prior block, each error block identified in the DUP mode output must have at least one control statement supplied for it.
- When multiple REP statements are provided, the identification numbers (SEQ=) must be in ascending block number sequence.

- If a block is identified as being in error even though the data is good, a control statement must be supplied for the block. Replace the first 4 bytes of the good block with the existing data. This is usually the case for the first block following an I/O error.
- If dual logs are used in DUP mode, supply a statement for only one of the two blocks in error, either Annnnn or Bnnnnn. The block not selected is ignored and is not written to the output log.
- If the log being recovered is an OLDS which has not been properly closed from either the WADS or next OLDS, the Log Recovery utility must be rerun in CLS mode using the output of REP mode as input.

PSB Mode—Print "Active PSBs" Report

PSB mode is used when a previous execution of this utility issued the following message:

```
DFS3272I X'47' LOG RECORD NOT FOUND.
ACTIVE PSB MESSAGES NOT GENERATED.
```

To get active region messages, the Log Recovery utility must be rerun in PSB mode (see "Example 7" on page 284 and "Example 8" on page 284). PSB mode can be used at any time to determine which PSBs are active.

PSB mode should not be run with an OLDS that is open. An incomplete listing results.

The format of this control statement is:

PSB
Indicates PSB mode.

Error Processing for DFSULTR0

The Log Recovery utility provides the following return codes:

Code	Meaning
0	Successful completion. If running CLS mode to terminate OLDS with WADS, ignore any error messages.

4	Successful completion—this condition code is accompanied by the following message:
	`DFS3272I X'47' LOG RECORD NOT FOUND.`
	`ACTIVE PSB MESSAGES NOT GENERATED.`

8	Unsuccessful completion. If the problem is due to a mismatch of the log release level and the utility release level, message DFS3062I also accompanies this error code.

These return codes can be tested by the COND= parameter on the EXEC statement of a later job step.

Related Reading: Refer to the *IMS Version 9: Messages and Codes, Volume 1* for descriptions of all error messages issued by DFSULTR0.

Examples of DFSULTR0

This section includes examples of the use of the Log Recovery utility.

Example 1

The following example shows how to close an OLDS from the WADS using CLS mode. The input data set is closed in place. The DBRC RECON data set is updated with the “close time.”

```
//EXAMPL01  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0,PARM='IMSID=iiiiiiii'
//*
//* NOTE - IMSID= is required
//* NOTE - Defaults are DBRC=YES
//* NOTE - DBRC=NO is not valid.
//*
//SYSPRINT  DD SYSOUT=A
//DFSOLP    DD ........  Primary   OLDS to be closed
//DFSOLS    DD ........  Secondary OLDS to be closed
//DFSPOLP   DD ........  Primary prior OLDS
//DFSPOLS   DD ........  Secondary prior OLDS
//DFSWADSn  DD ........  WADS used by on-line system
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
CLS
```

If no WADS were in use when the input OLDS or prior OLDS was created, remove the DFSWADSn DD statement and add the NOWADS keyword to the control statement.

If no prior OLDS are available, remove the DFSPOLP (and DFSPOLS) DD statement.

Example 2

The following example shows how to close an OLDS from the next-OLDS using CLS mode. The input data set is closed in place. The DBRC RECON data set is updated and the flag is turned off.

```
//EXAMPL02  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0,PARM='IMSID=iiiiiiii'
//*
//* NOTE - IMSID= is required
//* NOTE - Defaults are DBRC=YES
//* NOTE - DBRC=NO is not valid
//*
//SYSPRINT  DD SYSOUT=A
//DFSOLP    DD ........  OLDS to be closed from next-OLDS
//DFSNOLP   DD ........  next-OLDS
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
CLS
```

Example 3

The following example shows how to use DUP mode as the first of two steps in the recovery of an OLDS. The input data set is copied to an interim data set. Interim log records are created in the DBRC RECON.

Examples

```
//EXAMPL03  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0,PARM='IMSID=iiiiiiii'
//*
//* NOTE - IMSID= is required
//* NOTE - Defaults are DBRC=YES
//*
//SYSPRINT  DD SYSOUT=A
//DFSOLP    DD ........  Primary   OLDS to be recovered
//DFSOLS    DD ........  Secondary OLDS to be recovered
//NEWRDER   DD ........  Primary   interim data set
//NEWRDER2  DD ........  Secondary interim data set
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
DUP ERRC=nnnnn
```

If an ERRC value greater than zero is specified (the default is 99999), error blocks are written to the output data set, and a listing is produced for the blocks in error. REP mode is required to correct the errors and to remove error blocks. If no errors are found and the execution is successful, REP mode is not required.

When ERRC=00000 is specified, NEWRDER (and NEWRDER2) is closed when EOF or the first error is encountered on DFSOLP (and DFSOLS). If the execution is successful, REP mode is not required. If the execution is unsuccessful, DUP mode should be rerun with an ERRC value greater than zero and REP mode is required.

If the log being recovered is an OLDS which has not been properly closed from either the WADS or next OLDS, the Log Recovery utility must be rerun in CLS mode using the output of REP mode as input (or the output of DUP mode if no errors were detected).

See “Example 4” for REP mode.

Example 4

The following example shows how to use REP mode as the second of two steps in the recovery of an OLDS. The input data set is copied to a new OLDS. During the copy process, error blocks are removed and the blocks in error are corrected as directed by the REP control statements. The interim data set information in the DBRC RECON is deleted. The original OLDS information in the DBRC RECON is replaced by the output data set information.

```
//EXAMPL05  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0,PARM='IMSID=iiiiiiii'
//*
//* NOTE - IMSID= is required
//* NOTE - Defaults are DBRC=YES
//*
//SYSPRINT  DD SYSOUT=A
//DFSOLP    DD ........  Primary   interim data set
//DFSOLS    DD ........  Secondary interim data set
//NEWRDER   DD ........  Primary   recovered OLDS
//NEWRDER2  DD ........  Secondary recovered OLDS
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
REP  SEQ=A00001   POS=000018  DAT=83 (EXAMPLE ONLY)
REP  SEQ=A00002   SKIP
REP  SEQ=A00003   CLOSE
```

See “Utility Control Statements for DFSULTR0” on page 277 for an example of the formats of REP mode.

If the log being recovered is an OLDS which has not been properly closed from either the WADS or next OLDS, the Log Recovery utility must be rerun in CLS mode using the output of REP mode as input.

See “Example 3” on page 281 for DUP mode.

Example 5

The following example shows how to use DUP mode as the first of two steps in the recovery of an SLDS. The input data set is copied to an interim data set. Interim log records are created in the DBRC RECON.

```
//EXAMPL04  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0
//*        (PARM NOT REQUIRED - SEE NOTES BELOW)
//*
//* NOTE - IMSID= is ignored
//* NOTE - Defaults are DBRC=YES
//*
//SYSPRINT  DD SYSOUT=A
//IEFRDER   DD ........  Primary   SLDS to be recovered
//IEFRDER2  DD ........  Secondary SLDS to be recovered
//NEWRDER   DD ........  Primary   interim data set
//NEWRDER2  DD ........  Secondary interim data set
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
DUP ERRC=nnnnn
```

If an ERRC value greater than zero is specified (the default is 99999), error blocks are written to the output data set and a listing is produced for the blocks in error. REP mode is required to correct the errors and to remove error blocks. If no errors are found and the execution is successful, REP mode is not required.

See “Example 6” for REP mode. See “Example 9” on page 285 for DUP mode with ERRC=00000.

Example 6

The following example shows how to use REP mode as the second of two steps in the recovery of an SLDS. The input data set is copied to a new SLDS. During the copy process, error blocks are removed and the blocks in error are corrected as directed by the REP control statements. The interim data set information in the DBRC RECON is deleted. The original SLDS information in the DBRC RECON is replaced by the output data set information.

```
//EXAMPL06  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0
//*        (PARM NOT REQUIRED - SEE NOTES BELOW)
//*
//* NOTE - IMSID= is ignored
//* NOTE - Defaults are DBRC=YES
//*
//SYSPRINT  DD SYSOUT=A
//IEFRDER   DD ........  Primary   interim data set
//IEFRDER2  DD ........  Secondary interim data set
//NEWRDER   DD ........  Primary   recovered SLDS
//NEWRDER2  DD ........  Secondary recovered SLDS
```

Examples

```
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
REP  SEQ=A00001    POS=000018  DAT=83 (EXAMPLE ONLY)
REP  SEQ=A00002    SKIP
REP  SEQ=A00003    CLOSE
```

See “Utility Control Statements for DFSULTR0” on page 277 for an example of the formats of REP mode.

See “Example 5” on page 283 for DUP mode.

Example 7

The following example shows how to generate a listing of “active PSBs” after having received message `DFS3272I X'47' LOG RECORD NOT FOUND. ACTIVE PSB MESSAGES NOT GENERATED.` PSB mode is used.

```
//EXAMPL07  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0
//*
//* NOTE - IMSID= is ignored
//* NOTE - DBRC=YES is not valid
//* NOTE - Defaults are DBRC=NO
//*
//SYSPRINT  DD SYSOUT=A
//*
//* NOTE - The first log data set in the IEFRDER DD statement should
be the latest log data set containing the X'47' record.
//*
//IEFRDER  DD ........ next or prior OLDS or SLDS
//         DD ........ next or prior OLDS or SLDS
//         DD ........ next or prior OLDS or SLDS
   ⋮
//         DD ........ latest OLDS or SLDS
//*
//*
//SYSIN     DD *
PSB
```

The input logs must be concatenated in the sequence in which they were created, and there must not be any overlap or gap in log record content.

Example 8

The following example shows how to generate a listing of “active PSBs” from a concatenation of input logs (OLDS and SLDS). PSB mode is used.

```
//EXAMPL08  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0
//*
//* NOTE - IMSID= is ignored
//* NOTE - DBRC=YES is invalid
//* NOTE - Defaults are DBRC=NO
//*
//SYSPRINT  DD SYSOUT=A
//IEFRDR    DD ........  OLDS or SLDS
   ⋮
            DD ........  OLDS or SLDS
```

```
   ⋮
//          DD ........  OLDS or SLDS
//*                           (see note below)
//SYSIN     DD *
PSB
```

Requirement: The input logs must be concatenated in the sequence in which they were created. If OLDS and SLDS are mixed, there must not be any overlap in log record content.

Example 9

The following example shows how to close an SLDS created by IMS batch, using DUP mode and ERRC=00000. The input data set is copied to, and closed in, the output data set. The input SLDS information in the DBRC RECON is replaced by the output data set information.

```
//EXAMPL09  JOB ........
//*
//DFSULTR0 EXEC PGM=DFSULTR0
//*        (PARM NOT REQUIRED - SEE NOTES BELOW)
//*
//* NOTE - IMSID= is ignored
//* NOTE - Defaults are DBRC=YES
//*
//SYSPRINT  DD SYSOUT=A
//IEFRDER   DD ........  Primary   SLDS to be closed
//IEFRDER2  DD ........  Secondary SLDS to be closed
//NEWRDER   DD ........  Primary   output SLDS
//NEWRDER2  DD ........  Secondary output SLDS
//RECONn    DD ........  DBRC RECON data set(s)
//*                      (can be dynamically allocated)
//SYSIN     DD *
DUP ERRC=00000
```

When ERRC=00000 is specified, NEWRDER (and NEWRDER2) is closed when EOF or the first error is encountered on IEFRDER (and IEFRDER2). If the execution is successful, REP mode is not required. If the execution is unsuccessful, DUP mode should be rerun with an ERRC value greater than zero and REP mode is required.

See “Example 5” on page 283 for DUP mode with ERRC=nnnnn.

See “Example 6” on page 283 for REP mode.

If the input SLDS (IEFRDER, IEFRDER2) is a multiple volume tape data set, only the last volume needs to be specified on the DD statement. In addition, the data set name (DSN) on the output DD statement (NEWRDER, NEWRDER2) should be the same as the input. If the execution is successful, only the volume information is replaced in the DBRC RECON. ERRC=00000 is required.

Part 4. Analysis Utilities and Reports

Chapter 12. IMS Monitor Report Print Utility (DFSUTR20)

Use the IMS Monitor Report Print utility (DFSUTR20) to take the data collected by the IMS Monitor (DFSMNTR0) and print summary reports and distribution displays of the data. The report formats and the nature of information in the reports are identical or similar to those printed by the IMS DB Monitor Print utility (DFSUTR30).

The following topics provide additional information:

- "Restrictions for DFSUTR20"
- "Input and Output for DFSUTR20"
- "JCL Requirements for DFSUTR20"
- "Example of DFSUTR20" on page 293

Restrictions for DFSUTR20

The following restrictions apply to the IMS Monitor Report Print utility:

- If the Monitor does not collect the types of information usually found in a particular report, that report, or the section of that report that would normally contain the information, is not produced. For example, if no checkpoints occur, only the headings for checkpoint are printed.
- In any report for which data is captured at the start and end of the Monitor trace interval, the report displays the data captured at these intervals, and their difference. Because data for these reports is needed at both intervals, these reports are **not** generated if the IMS control region is terminated prior to the termination of the Monitor trace.
- The Monitor must not be left on for more than 9999999 total DL/I calls if you plan to use Region Summary, Region Wait, Run-Profile, or Call-Summary (DB) reports. After 9999999 DL/I calls, truncation occurs in the various totals fields of these reports.

Most of the terms used in reports printed by the IMS Monitor Report Print utility (DFSUTR30) also appear in reports printed by the IMS Monitor Report Print utility (DFSUTR20).

Input and Output for DFSUTR20

The Monitor Report Print utility runs as a batch program, with a sequential data set on DASD or tape as input. The contents of this data set are created by the IMS Monitor module (DFSMNTR0) in response to a `/TRACE SET ON MONITOR` command during IMS online execution.

Related Reading: See Chapter 18, "Interpreting IMS Monitor Reports," on page 381 for detailed information on output from the reports and an explanation of how to read them.

JCL Requirements for DFSUTR20

// JOB
Initiates the job.

// EXEC
Specifies the program name. The statement must be in the form:

```
// EXEC PGM=DFSUTR20,REGION=4096K
```

DD Statements

STEPLIB DD
Points to IMS.SDFSRESL, which contains the IMS nucleus and required action modules.

//SYSPRINT DD
Specifies the output data set that is to contain the reports and control messages. It is usually coded as SYSOUT=A. The DCB parameters for this data set are RECFM=FBA and LRECL=133. BLKSIZE can be provided on the SYSPRINT DD statement and must be a multiple of 133. If the BLKSIZE is not provided, a default value of 133 will be used.

//SYSUT1 DD
Specifies the input data set to be analyzed. It is a labeled sequential data set written by the monitor module DFSMNTR0. (The ddname and dsname are IMSMON in the IMS procedure.)

//ANALYSIS DD
Specifies the Analysis Control data set. This file must be in card image format.

Analysis Control Data Set

The Analysis Control data set determines which reports to print and allows for distribution redefinition for the Distribution reports. See “Specifying Distribution Redefinition” for information on how to redefine the distributions.

- If you are printing only the Call Summary report, include the ONLY DLI statement in the Analysis Control data set for this run. The statement starts in card image column 1.
- To generate the Call Summary report, include the DLI statement in the Analysis Control data set for this run. If this statement is not included, the default option is taken; that is, all reports except the Call Summary report are printed. The statement starts in card image column 1.
- To generate the optional Distribution Appendix report, include the DIS statement anywhere in the Analysis Control data set. If this statement is not included, only the summary reports are printed. The statement starts in card image column 1.

If none of these options are selected, all reports except the Call Summary report and the Distribution Appendix report will be printed.

Specifying Distribution Redefinition

The general format for specifying a user redefinition of a distribution is:

```
Dn     n1,n2...
```

Dn
Starts in column 1 and is the distribution identifier (ID).

n1 through n9
Are each 8 digits or less, and each is a positive number between 0 and 99999999.

Each redefinition can occupy more than one statement, if necessary. The format for continuation statements follows the z/OS rules:

- The last value on the first statement must be followed by a comma and at least one blank.

- The first value on the continuation statement cannot start before column 2 nor after column 10.
- Comments can be included if they are preceded by at least one blank.

Assume that the distribution for region elapsed execution time is identified as D1 and has a default definition of:

```
0 1 2 3 30 300 3000 30000 3000000 30000000 INF
```

It can be redefined to be:

```
0 1 2 5 30 40 50 60 3000000 30000000 INF
```

This redefinition is accomplished by the following record in the Analysis Control data set:

```
D1 1,2,5,30,40,50,60,3000000,30000000
```

Because the numbers are positional parameters, the same redefinition could have been obtained by specifying the following:

```
D1 ,,5,,40,50,60
```

Related Reading: Refer to *IMS Version 9: Administration Guide: System* for the default values for each distribution identifier and explanation of the distributions used by the various reports.

Example of DFSUTR20

The following JCL produces a complete set of reports, including the Call Summary report, from a tape with a serial number of IMSDA1.

```
//TRACE    JOB (969,6014),CHAPMAN,MSGLEVEL=(1,1),CLASS=A
//*
//        EXEC PGM=DFSUTR20,REGION=512K
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUDUMP  DD SYSOUT=A
//SYSUT1    DD DSNAME=IMSMON,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=IMSDA1
//ANALYSIS  DD *
DLI CALL REPORT
DISTRIBUTION
/*
```

If the distribution for D30 and D2 are modified, the JCL is modified as follows:

```
       .
       .
       .
//ANALYSIS DD *
DLI CALL REPORT
DISTRIBUTION
D30 8000,24000,50000,75000
D2 1000,2000,3000,4000,5000,6000,7000,8000,9000
/*
```

Example

Chapter 13. File Select and Formatting Print Utility (DFSERA10)

Use the File Select and Formatting Print utility (DFSERA10) to assist in the examination and display of data from the IMS log data set. The utility can:

- Print or copy an entire log data set
- Print or copy from multiple log data sets based upon control statement input
- Select and print log records on the basis of sequential position in the data set
- Select and print external trace data sets
- Select and print log records based upon data contained within the record itself, such as the contents of a time, date, or identification field
- Allow exit routines to special process any selected log records

Use a series of control statements to define the input and output options, selection ranges, and various field and record selection criteria.

The following topics provide additional information:

Related Reading:

- To print CQS log records, use the CQSERA30 exit. See *IMS Version 9: Common Queue Server Guide and Reference* for more information.
- Several Knowledge-Based Log Analysis (KBLA) utilities are run as exit routines of DFSERA10, including DFSKBLA3, DFSKBLA6, DFSKBLA7, DFSKBLA8, DFSKBLA9, DFSKBLAK, DFSKBLAS, DFSKDBC0, DFSKSCR0, DFSKMSC0, and DFSKDVS0. You can use KBLA to build JCL and execute DFSERA10 with these exit routines. For more information on these utilities, see Part 6, "Knowledge-Based Log Analysis," on page 501.

Input and Output for DFSERA10

All data input is processed using QSAM and can reside on either tape or direct-access storage devices. Data set organization must be physical sequential. The record format can be fixed or variable in length, blocked or unblocked, or of undefined length. You can use multiple input and output data sets, and they can reside on different device types.

The data set containing control information must have a record length of 80. These statements are reproduced on the output print data set in the same format and

sequence as they are processed. If error conditions are encountered, error messages are produced following the statement to which they apply.

Output data can be formatted and printed on the SYSPRINT data set, copied to a specified data set unchanged, or both.

Data to be printed is formatted into 32-byte segments and displayed in both hexadecimal and EBCDIC forms, with the hexadecimal relative offset value preceding each segment.

The flow of control for the program passes through two major stages:

- Control statement processing, where construction of record test and selection parameters takes place and control statement errors are diagnosed
- Record selection and output processing, where the input data is read, analyzed, and compared with the selection parameters to determine the applicability of the record for output

The first phase reads and examines the parameter statements and constructs the required test or test series to create a test group. This test group is then used in record selection when control passes to the next phase of the program. The second phase reads the input data and determines the disposition by the results of each test in the group. When the end of the input data is reached, either by encountering an end-of-file condition or the satisfying the indicated record count, program control shifts back to phase one, where the next group of tests is constructed.

JCL Requirements for DFSERA10

The File Select and Formatting Print utility executes as a standard operating system job. You must define a JOB statement, an EXEC statement, and DD statements defining input and output.

EXEC

Must be in the format

```
// EXEC PGM=DFSERA10
```

Alternatively, the EXEC statement can be included in a cataloged procedure.

DD Statements

STEPLIB DD

Defines a partitioned data set containing the EXIT routine modules. If EXIT routines are not used or if the modules reside in LINKLIB, this statement is not required.

SYSPRINT DD

Describes the output data set to contain the formatted print records and control messages. It is usually defined as SYSOUT=A.

DCB parameters specified for this data set are RECFM=FBA and LRECL=133. Block size can be provided on the SYSPRINT DD statement and must be a multiple of 133. The default is 133.

SYSIN DD

Describes the input control data set. This file must contain fixed-length 80-character records.

input or data DD
Defines the input data set to be examined to produce the formatted print records.

These data sets must be standard labeled files, either direct-access or tape. They can be of any record format (F, FB, V, VB, VBS, or U), as long as they are of DSORG=PS.

If a file with RECFM=U is used, the DCB BLKSIZE parameter must be specified. These files are processed using QSAM. Any file that QSAM supports can be described as input.

If a ddname is not specified in the CONTROL statement, the default ddname used is SYSUT1.

output or data DD
Defines the optional output data set to contain the selected records.

DFSERA10 sets the RECFM of this data set equal to the RECFM specified for the input data set. This is also done for LRECL and BLKSIZE if not specified.

The default ddname used is SYSUT4.

Utility Control Statements for DFSERA10

This utility uses three types of control statements. You can use an additional statement type to provide titles or comments on the output listings. Keyword operands on these statements can be extended to additional statements, to a maximum of 9, by placing a nonblank character in position 72 and continuing the parameter in position 16 of the next statement. Each full keyword has an abbreviation that you can use.

The CONTROL statement defines the ddnames used for the input and output data sets and the beginning and ending limits of the data set being scanned. This statement is optional if the default parameter values are satisfactory.

The OPTION statement defines the test or series of tests performed on the data of the candidate record to determine its qualification for selection. You can execute one or more tests on each logical record by the appropriate number of OPTION statements, creating the logical “OR” function. You can analyze records with the logical “AND” function by creating a test series using the multifield test capability of the COND parameter and the necessary number of OPTION statements. Use the operands COND=M and COND=E to denote the beginning and ending, respectively, of a series for multifield testing of a record.

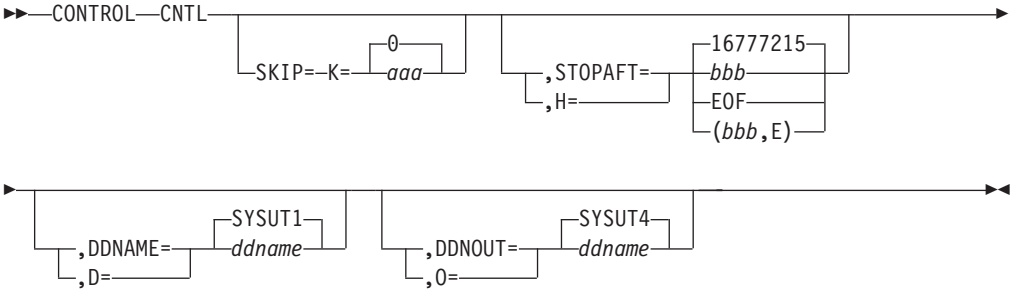
Each OPTION function has its own output processing defaults. If you use multiple OPTION functions to create a multifield test series, final output processing is determined by the OPTION statement coded with the COND=E keyword.

Use the END statement as a delimiter to separate one group of tests (made up of one or more OPTION statements) from subsequent groups of tests on the next data set. When an END statement is encountered in the control input stream, the construction of record selection parameters ceases and the processing of input data records starts. Proper use of the END statement allows one execution of the utility program to perform a varied number of tests on one or more IMS log data sets.

You can use the * or COMMENTS statement to include any information in identifying tests or data. It has no effect on the utility program.

CONTROL Statement

The CONTROL statement is optional. If it is not specified, the SYSUT1 input file is examined. The optional output data set defined on the SYSUT4 DD statement is opened only if you specify the OPTION COPY function in the current group of tests. This data set is used only if COND=E is also specified.



CONTROL or CNTL
Identifies the CONTROL statement.

SKIP= or K=
Defines the first record tested. All prior records are ignored.

If this keyword is not specified, a default value of zero is used and the first record on the input file is tested.

aaa
Must be specified in the range of zero to 99999999, and cannot have embedded commas.

STOPAFT= or H=
Defines the last record to be tested. The current group of tests terminates when this value has been reached by counting processed records.

If this keyword is not specified, a default value of 16777215 is used.

If the STOPAFT parameter uses the default value of 16777215 and message DFS707I indicating EOF does not appear, the records after 16777215 have not been processed.

bbb
Must be specified in the range of 1 to 99999999, with no embedded commas. If the value zero is specified, one record is processed.

EOF
Denotes end-of-file condition. Use of the EOF parameter allows record processing beyond the stated maximum of 99999999 records.

E Causes records to be counted for test sequence termination only if they satisfy selection criteria. Otherwise, all records read (after the SKIP value) are counted.

DDNAME= or D=
Identifies the input data set for the current group of tests. A corresponding DD statement must be supplied.

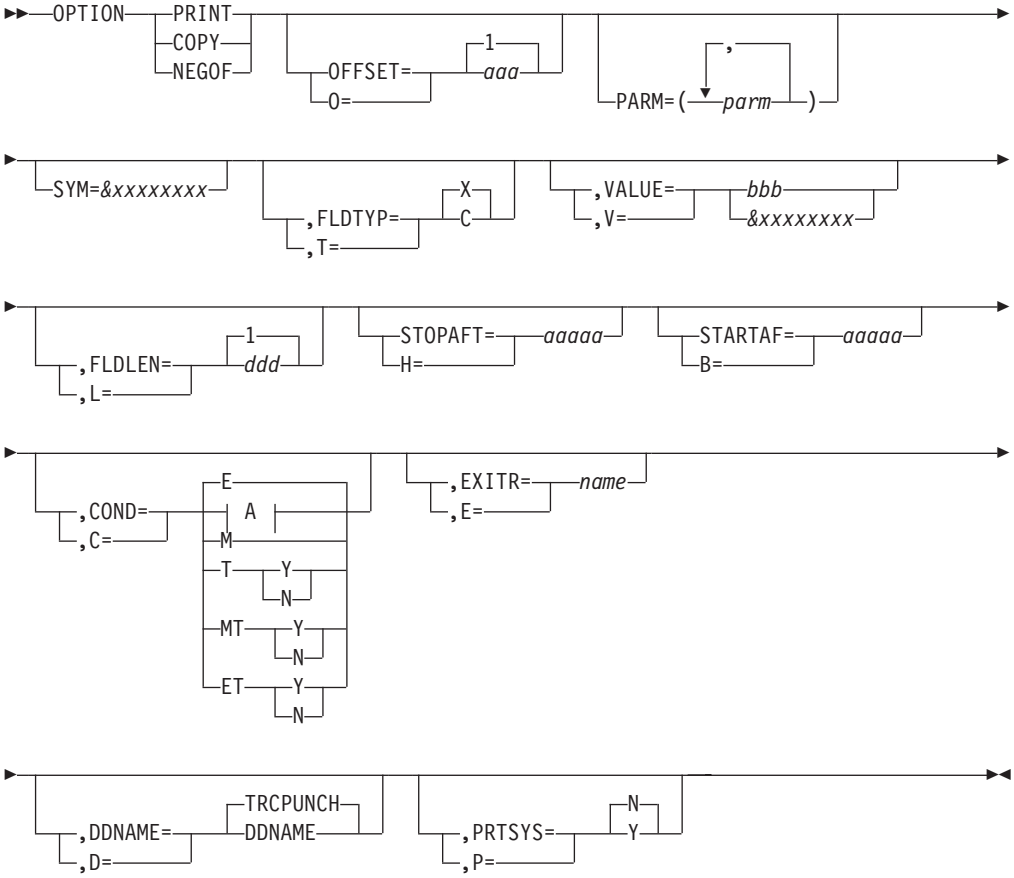
If this keyword is not specified, a default of SYSUT1 is used and the appropriate DD statement must be supplied.

DDNOUT= or O=
Identifies the optional output data set for the current group of tests.

This keyword is used with the OPTION COPY function and is only required if a ddname other than the default of SYSUT4 is required. (DDNOUT or the presence of SYSUT4 will not cause this data set to be used; this data set will be used only if OPTION COPY is specified with COND=E.)

OPTION Statement

The OPTION statement constructs one set of tests. One or more OPTION functions can be specified in any combination desired to further define the selection criteria and output processing performed against each input record. Except for EXITR and DDNAME keyword operands, omitting the keyword operands causes all records processed by phase 2 of this program to be displayed on the SYSPRINT data set or transferred to the specified output data set.



A:

Options

Each option has two distinct functions:

1. Determines starting position for OFFSET keyword
2. Determines output processing to be performed

If individual options are combined to form a multifield test, the use of OFFSET remains unchanged; however, output processing is determined by the OPTION coded with the COND=E keyword.

PRINT
Causes all selected records to be displayed on the SYSPRINT data set.

COPY
Causes all selected records to be transferred to the specified output data set. These records can also be displayed on the SYSPRINT data set by use of the PRTSYS keyword.

NEGOF
Causes the OFFSET keyword value to be used as a negative offset from the end of the log record. All records selected using this function are displayed on the SYSPRINT data set.

Keywords

The following keywords are all optional:

OFFSET= or O=
Is used to define the location of the first byte of the field to be tested in the record. The default is position one of the record.

aaa
Must be specified in the range from 1 up to and including the length of the record under test. Maximum value is 32767 bytes. No checking is performed to determine if the logical record length is exceeded.

If you use DSECTs to locate values in control records or blocks, you must adjust the starting value for the OFFSET parameters. Most DSECTs start with a relative value of ZERO, while the value specified in the OFFSET keyword is always expressed as relative to byte 1.

PARM=
Is used to pass parameters to the DFSERA70 exit routine. For a description of the possible parameters, see “Enhanced Select Exit Routine (DFSERA70)” on page 321.

SYM=
Is used to define a value as a symbol. This option replaces the VALUE keyword and must not be used in the same element tests as the VALUE= keyword.

&xxxxxxxx
Is the unique name of a symbol. The '&' is the recognition character. The 'xxxxxxxx' is a 1- to 8-character symbol name. It must be unique for each SYM= specified. This symbol can be used for a VALUE= option in one or many of the following elements in a test series.

FLDTYP= or T=
Is used to define the type of data in the VALUE=field.

X Defines the data to be treated as hexadecimal pairs. The test data is packed (2 bytes into one to form hexadecimal equivalents). This is the default value.

Example: If VALUE=D9D6D6E3E2C5C7 (14 bytes) is specified with the FLDTYP=X parameter, the resultant VALUE= is: ROOTSET in EBCDIC or D9D6D6E3E2C5C7 in hexadecimal; in either case, the length is only 7 bytes.

C Defines the data to be treated as EBCDIC. The test data is used as punched in the card, with no alterations.

VALUE= or V=
Defines the characters of the test field. If FLDTYPE=X is specified, this data must be entered as hexadecimal character pairs. For a "test under mask" condition, a single pair must represent the hexadecimal value for the test. If FLDTYP=C is specified, this data must be entered as EBCDIC characters. If the character of blank or comma is to be included in this parameter, FLDTYP=X must be used with the appropriate hexadecimal equivalent.

Restriction: This option must not be used in the same element test as the SYM= keyword.

bbb
Cannot exceed 255 EBCDIC or 510 hexadecimal characters. The length of this field is determined by the FLDLEN= keyword value and not by the number of "nonnull" characters in this field.

&xxxxxxxx
Is the symbol name of a preceding SYM= option. Each symbol has a value associated with it that is determined by the SYM= option.

FLDLEN= or L=
Defines the number of characters to be used from the test field.

ddd
Represents the actual number of bytes to be used, not the number of characters specified in the VALUE= keyword. The acceptable range of values for this field is 1 to and including 255. The default is 1.

STOPAFT= or H=
Defines the number of records to be selected for a single test or a multifield test. This statement can only be specified on the COND=E control statement for each element test.

aaaaa
Can be from 0 to 32767 elements.

STARTAF= or B=
Defines the number of selected records to be skipped for a single or a multifield test. This statement can only be specified on the COND=E control statement for each element test.

aaaaa
Can be from 0 to 32767 elements.

COND= or C=
Defines the type of test and its relationship to other tests in the group. If this keyword is not specified, the default is COND=E.

E Marks the last (or only) element in a test series. Any OPTION control statements appearing after this form a new series of tests. This allows various tests to be performed on each record and each test series can be used on different fields within the record. Final output processing is determined by the OPTION function defined with this keyword value.

I Tests the VALUE= value. The record passes if the test fails. This option can stand alone or precede the E, M, or T parameters.

M Indicates that this is a multifield test. All tests in this series must be satisfied before final output selection and processing of this record begins.

T Causes the VALUE= byte to be used as a “test under mask” value, instead of a compare field. Only the first byte (two hexadecimal characters if FLDTYP=X) of the VALUE= field is used. If FLDTYP=C is used, the hexadecimal equivalent of the EBCDIC character is the test value. If this parameter is used, the FLDLEN= keyword must not be specified and a default length of 1 is assumed.

Y Indicates that, for the “test under mask” to be considered satisfied, there must be a bit in the record test field for each corresponding bit of the test byte. This is equivalent to a “branch if ones” test.

N Indicates that, for the “test under mask” to be considered satisfied, there must not be a bit in the record test field for any of the corresponding bits of the test byte. This is equivalent to a “branch if zeros” test.

MT
Defines a “test under mask” OPTION as described in 302 but with the properties of a multifield test as described in the M parameter. Because the T parameter assumes a default value of 1,e, the MT parameter must be used for a multifield test that starts with a “test under mask” value.

ET
Indicates that a multifield test series ends with “test under mask” condition.

EXITR= or E=
Specifies the entry point name of an exit routine to be given control when a candidate record has satisfied all selection criteria for the current test.

If multiple test groups have specified the same exit routine, an attempt is made to load the routine into storage for each group; therefore, the routine should be re-enterable. Upon reaching end of file on input, a final call is made to the exit routine. You can determine if end of file was reached by checking for zeros in the parameter field.

Interface to the exit routine is as follows:

ENTRY:

REGISTERS

R1 Contains a pointer to a parameter list.

R13 Points to an empty save area.

R14 Contains a return address.

R15 Contains the exit routine entry address.

PARMLIST

The parameter list consists of two words, the first is a pointer to the candidate record; the second (with the high order bit on) is a pointer to the SYSPRINT data set DCB.

EXIT:

Upon return from the exit routine, register 15 is used to determine whether or not processing is to continue on this record.

A nonzero value indicates that no further processing is done on this record, and selection tests start again against the next input record.

A zero value indicates that this record is required, and output processing is now determined based upon the last OPTION statement encountered containing the COND=E keyword.

If the EXITR keyword is omitted, processing continues as though a return code value of zero had been received.

DDNAME= or D=
Defines the output data set used by the DL/I call trace log record retrieval routine (DFSERA50) whenever it is specified as the user exit routine. A corresponding DD statement must be supplied.

If this keyword is not specified and DFSERA50 is the exit routine, a default of TRCPUNCH is used and the appropriate DD statement must be supplied.

PRTSYS= or P=
Is used to display selected records on the SYSPRINT data set.

N Indicates that no printing of selected records is done.

Y Indicates that all records transferred to the output data set are also formatted and printed.

This keyword can only be used with OPTION COPY function. N is the default.

END Statement

When you have defined all tests for the current input file, use the END statement to execute those tests.

END is entered at position 1. Positions 10 and on can be used for comments.

COMMENTS Statement

The COMMENTS statement is optional. If used, the contents are displayed on the SYSPRINT data set.

An asterisk (*) entered at position 1 indicates a comment.

Examples for DFSERA10

The following examples illustrate some of the ways you can use DFSERA10. Most of the examples refer to the IMS log data set; however, you can use this utility with any data set that can be processed using QSAM.

For clarity, all option keywords are specified in full form, and many are coded where the default could be taken. Use of the short form and keyword defaults greatly reduces the input required. Each example makes use of the COMMENTS statement to describe the functions being performed.

Example 1

This example shows the JCL and control statements required to print or copy all log records from an IMS log data set.

```
//EXAMPLE1 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUT1    DD DSN=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=123456.LABEL=(,SL)
//SYSUT4    DD DSN=EXAMPLE1.COPY1,DISP=(NEW,PASS),
```

Examples

```
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE=(TRK,(3,1))
//SYSIN     DD *
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : DEFAULTS                                  *
*                 INPUT = SYSUT1                                    *
*                OUTPUT = SYSPRINT                                  *
*  SELECTION QUALIFIERS :                                           *
*            1. DEFAULT = ALL INPUT RECORDS                         *
*-------------------------------------------------------------------*
OPTION   PRINT
END
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : DEFAULTS                                  *
*                 INPUT = SYSUT1                                    *
*                OUTPUT = SYSUT4                                    *
*  SELECTION QUALIFIERS :                                           *
*            1. DEFAULT = ALL INPUT RECORDS                         *
*-------------------------------------------------------------------*
OPTION   COPY
END
*-------------------------------------------------------------------*
/*
```

Example 2

This example shows two ways of selecting and printing all log records of a specific type:

- Specifying one selection qualifier:`TYPE X'16' IN 5TH BYTE = (ALL /SIGN ON/OFF)`
- Specifying two selection qualifiers: `TYPE X'16' IN 5TH BYTE = (LOG RECORD TYPE)` and `FLAG X'01' IN 6TH BYTE = 1 (/SIGN ON - ONLY)`

```
//EXAMPLE2 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//LOGIN     DD DSN=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=123456,LABEL=(,SL),
//SYSIN     DD *
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                                 *
*                 INPUT = LOGIN                                     *
*                OUTPUT = SYSPRINT                                  *
*  SELECTION QUALIFIERS :                                           *
*            1. TYPE X'16' IN 5TH BYTE = (ALL /SIGN ON/OFF)       *
*-------------------------------------------------------------------*
CONTROL  CNTL  DDN=LOGIN
OPTION   PRINT OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
END
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                                 *
*                 INPUT = LOGIN                                     *
*                OUTPUT = SYSPRINT                                  *
*  SELECTION QUALIFIERS :                                           *
*            1. TYPE X'16' IN 5TH BYTE = (LOG RECORD TYPE)        *
*            2. FLAG X'01' IN 6TH BYTE = 1 (/SIGN ON - ONLY)      *
*-------------------------------------------------------------------*
CONTROL  CNTL  DDN=LOGIN
OPTION   PRINT OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=M
OPTION   PRINT OFFSET=6,FLDTYP=X,VALUE=01,COND=ETY
END
*-------------------------------------------------------------------*
/*
```

Example 3

This example shows how to print or copy two log record types, each containing a field value (USERID) common to both, but residing at different offsets depending upon the record type.

```
//EXAMPLE3 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSN=IMS.&SYS2..SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//LOGIN     DD DSN=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=123456,LABEL=(,SL)
//LOGOUT    DD DSN=EXAMPLE3.COPY1,DISP=(NEW,PASS),
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE(TRK,(3,1))
//SYSIN     DD *
*-------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                           *
*                  INPUT = LOGIN                              *
*                 OUTPUT = SYSPRINT                           *
*  SELECTION QUALIFIERS :                                     *
*            1. LOG RECORD TYPE X'16'                         *
*               USERID IN 9TH BYTE (FROM BEGINNING OF RECORD) *
*            2. LOG RECORD TYPE X'50'                         *
*               USERID IN 12TH BYTE (FROM END OF RECORD)      *
*-------------------------------------------------------------*
CONTROL  CNTL  DDNAME=LOGIN
OPTION   PRINT OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=M
OPTION   PRINT OFFSET=9,FLDTYP=C,VALUE=USERAAAA,FLDLEN=8,COND=E
OPTION   PRINT OFFSET=5,FLDTYP=X,VALUE=50,FLDLEN=1,COND=M
OPTION   NEGOF OFFSET=12,FLDTYP=C,VALUE=USERAAAA,FLDLEN=8,COND=E
END
*-------------------------------------------------------------*
*-------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                           *
*                  INPUT = LOGIN                              *
*                 OUTPUT = LOGOUT                             *
*  SELECTION QUALIFIERS :                                     *
*            *  THE SAME AS FOR THE 'PRINT' AND 'NEGOF' OPTIONS  *
*            ABOVE, BUT SINCE THE 'COPY' OPTION DEFINES AN OUTPUT*
*            DATA SET OTHER THAN SYSPRINT, THIS OPTION MUST BE   *
*            CODED WITH THE 'COND=E' KEYWORD.                    *
*-------------------------------------------------------------*
CONTROL  CNTL  DDN=LOGIN,DDNOUT=LOGOUT
OPTION   PRINT OFFSET=9,FLDTYP=C,VALUE=USERAAAA,FLDLEN=8,COND=M
OPTION   COPY  OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
OPTION   NEGOF OFFSET=12,FLDTYP=C,VALUE=USERAAAA,FLDLEN=8,COND=M
OPTION   COPY  OFFSET=5,FLDTYP=X,VALUE=50,FLDLEN=1,COND=E
END
*-------------------------------------------------------------*
/*
```

Example 4

This example selects all specified log record types, each containing a common userid value, and both print and transfer these records to the specified output data set.

```
//EXAMPLE4 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSNAME=IMS.SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//LOGIN     DD UNIT=TAPE,DISP=(OLD,KEEP),LABEL=(,SL),
//LOGIN     DD DSNAME=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=IMSPAC,LABEL=(,SL)
```

Examples

```
//LOGOUT    DD DSNAME=EXAMPLE4.COPY1,DISP=(NEW,PASS),
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE=(TRK,(3,1))
//SYSIN     DD *
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                                 *
*                  INPUT = LOGIN                                    *
*                 OUTPUT = (SYSPRINT AND LOGOUT)                    *
*                  *  SINCE MULTIFIELD TESTS ARE BEING USED,       *
*                  AND CONSIST OF MULTIPLE OPTION FUNCTIONS,        *
*                  FINAL OUTPUT PROCESSING OF THE SELECTED RECORD   *
*                  IS BASED UPON THE 'COPY' OPTION AND 'PRTSYS=Y'   *
*                  KEYWORD BEING CODED WITH 'COND=E'.               *
*  SELECTION QUALIFIERS :                                           *
*             1. USERID = USERBBBB                                  *
*             2. LOG RECORD TYPES (X'16',X'50',X'51',X'52')         *
*-------------------------------------------------------------------*
CONTROL  CNTL  DDNAME=LOGIN,DDNOUT=LOGOUT
OPTION   PRINT OFFSET=9,FLDTYP=C,VALUE=USERBBBB,FLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
OPTION   NEGOF OFFSET=12,FLDTYP=C,VALUE=USERBBBB,FLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=50,FLDLEN=1,COND=E
OPTION   NEGOF OFFSET=12,FLDTYP=C,VALUE=USERBBBB,GLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=51,FLDLEN=1,COND=E
OPTION   NEGOF OFFSET=12,FLDTYP=C,VALUE=USERBBBB,FLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=52,FLDLEN=1,COND=E
END
*-------------------------------------------------------------------*
/*
```

Example 5

This example copies selected log records to individual output data sets in one execution of DFSERA10. All selected records are printed.

```
//EXAMPLE5 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSNAME=IMS.SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUT1    DD DSNAME=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=123456,LABEL=(,SL)
//LOGOUT1   DD DSNAME=EXAMPLE5.COPY1,DISP=(NEW,PASS),
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE=(TRK,(3,1))
//LOGOUT2   DD DSNAME=EXAMPLE5.COPY2,DISP=(NEW,PASS),
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE=(TRK,(3,1))
//LOGOUT3   DD DSNAME=EXAMPLE5.COPY3,DISP=(NEW,PASS),
//             UNIT=SYSDA,VOL=SER=IMSPAC,
//             SPACE=(TRK,(3,1))
//SYSIN     DD *
*-------------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                                 *
*                  INPUT = DEFAULT (SYSUT1)                         *
*                 OUTPUT = SYSPRINT AND (LOGOUT1,LOGOUT2,LOGOUT3)   *
*  SELECTION QUALIFIERS :                                           *
*             1. LOG RECORD TYPE X'16'                              *
*             2. USERIDS = (USERAAAA,USERBBBB,USERCCCC)             *
*-------------------------------------------------------------------*
CONTROL  CNTL  DDNOUT=LOGOUT1
OPTION   COPY  OFFSET=9,FLDTYP=C,VALUE=USERAAAA,FLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
END
*-------------------------------------------------------------------*
CONTROL  CNTL  DDNOUT=LOGOUT2
OPTION   COPY  OFFSET=9,FLDTYP=C,VALUE=USERBBBB,FLDLEN=8,COND=M
```

```
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
END
*-----------------------------------------------------------------*
CONTROL  CNTL  DDNOUT=LOGOUT3
OPTION   COPY  OFFSET=9,FLDTYP=C,VALUE=USERCCCC,FLDLEN=8,COND=M
OPTION   COPY  PRTSYS=Y,OFFSET=5,FLDTYP=X,VALUE=16,FLDLEN=1,COND=E
END
*-----------------------------------------------------------------*
/*
```

Example 6

This example shows the JCL and control statements required to print record 158 of an OSAM image copy data set and all type X'50' records on a log data set that refer to this block number (assuming unblocked OSAM).

```
//EXAMPLE6 JOB
//*
//        EXEC PGM=DFSERA10
//STEPLIB   DD DSNAME=IMS.SDFSRESL,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUT1    DD DSNAME=IMSLOG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=123456,LABEL=(,SL)
//IMAGFILE  DD DSNAME=OSAMIMAG,DISP=(OLD,KEEP),
//             UNIT=TAPE,VOL=SER=456789,LABEL=(,SL)
//SYSIN     DD *
*-----------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                               *
*                  INPUT = IMAGFILE                               *
*                 OUTPUT = SYSPRINT                               *
*  SELECTION QUALIFIERS :                                         *
*           1. OSAM RBN = 0000009E (RECORD NO. 158)               *
*-----------------------------------------------------------------*
CONTROL  CNTL  STOPAFT=(1,E),DDNAME=IMAGFILE
OPTION   PRINT OFFSET=1,FLDTYP=X,VALUE=0000009E,FLDLEN=4,COND=4
END
*-----------------------------------------------------------------*
*     CONTROL STATEMENT : DEFAULTS                                *
*                  INPUT = SYSUT1                                 *
*                 OUTPUT = SYSPRINT                               *
*  SELECTION QUALIFIERS :                                         *
*           1. LOG RECORD TYPE X'50'                              *
*           2. DATABASE NAME = DATABAS1                           *
*           3. FLAG X'04' IN 7TH BYTE = 0 (OSAM DATA SET)         *
*           4. OSAM RBN = 0000009E                                *
*-----------------------------------------------------------------*
OPTION  PRINT OFFSET=5,FLDTYP=X,VALUE=50,FLDLEN=1,COND=M
OPTION  PRINT OFFSET=53,FLDTYP=C,VALUE=DATABAS1,FLDLEN=8,COND=M
OPTION  PRINT OFFSET=7,FLDTYp=X,VALUE=04,COND=MTN
OPTION  PRINT OFFSET=43,FLDTYP=X,VALUE=0000009E,FLDLEN=4,COND=E
END
*-----------------------------------------------------------------*
/*
```

Example 7

This example shows the JCL and control statements required to print all type X'50' records, where the database name (beginning with the 53rd byte) is not equal to DB01DS01, and to print all type X'25' records.

The second set of control statements uses a symbolic keyword to select the database name, beginning with the 9th byte of the first type X'25' record. Using the same symbolic name for the value in the next control statement, all type X'50' records (except the first) that have the same database name are to be printed beginning with the 53rd byte.

Examples

```
//EXAMPLE7 JOB
//         EXEC PGM=DFSERA10
//STEPLIB  DD   DSNAME=IMS.SDFSRESL,DISP=SHR
//SYSPRINT DD   SYSOUT=A
//LOGIN    DD   DSNAME=IMSLOG,DISP=(OLD,KEEP),
//              UNIT=TAPE,VOL=SER=123456.LABEL=(,SL)
//SYSIN    DD   *
*****************************************************************
*   CONTROL STATEMENT : SPECIFIED                               *
*                INPUT : LOGIN                                  *
*               OUTPUT : SYSPRINT                               *
* SELECTION QUALIFIERS:                                         *
*           1. LOG RECORD TYPE X'50'                            *
*              ¬= DB01DS01 STARTING IN THE 53rd BYTE            *
*              (DATABASE NAME) PRINT 5 LOG RECORDS              *
*           2. LOG RECORD TYPE X'25'                            *
*****************************************************************
CONTROL  CNTL  DDNAME=LOGIN
OPTION   PRINT OFFSET=5,FLDTYP=X,FLDLEN=1,VALUE=50,C=M
OPTION   PRINT OFFSET=53,T=C,L=8,V=DB01DS01,H=5,C=IE
OPTION   PRINT OFFSET=5,T=X,L=1,V=25,C=E
END
*****************************************************************
*   CONTROL STATEMENT : SPECIFIED                               *
*                INPUT : LOGIN                                  *
*               OUTPUT : SYSPRINT                               *
* SELECTION QUALIFIERS:                                         *
*           1. LOG RECORD TYPE X'25'                            *
*              DEFINE SYMBOL &DBNAME STARTING IN THE 9th BYTE   *
*              (DATABASE NAME ) & PRINT 1 RECORD                *
*           2. LOG RECORD TYPE X'50'                            *
*              USE SYMBOL &DBNAME FOR DATABASE NAME STARTING    *
*              IN THE 53rd BYTE & SKIP THE FIRST SELECTED       *
*              RECORD                                           *
*****************************************************************
CONTROL  CNTL  DDNAME=LOGIN
OPTION   PRINT OFFSET=5,FLDTYP=X,FLDLEN=1,VALUE=25,C=M
OPTION   PRINT OFFSET=9,T=C,L=8,SYM=&DBNAME,STOPAFT=1,C=E;
OPTION   PRINT OFFSET=5,FLDTYP=X,FLDLEN=1,VALUE=50,C=M
OPTION   PRINT OFFSET=53,T=C,L=8,V=&DBNAME,STARTAF=1,C=E;
END
```

Example 8

This example shows the JCL and control statements required to print an external trace data set.

```
//EXAMPLE8 JOB MSGLEVEL=(1,1)
//*
//PRTTAB  EXEC PGM=DFSERA10
//SYSUT1    DD DSN=IMS.EXTERNAL.TRACE,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSIN     DD *
*-----------------------------------------------------------------*
*     CONTROL STATEMENT : SPECIFIED                               *
*                  INPUT = SYSUT1                                 *
*                 OUTPUT = SYSPRINT                               *
*  SELECTION QUALIFIERS :                                         *
*           1. Log record typeX'67FA' in fifth and sixth         *
*              byte = (all trace log records)                     *
*-----------------------------------------------------------------*
CONTROL  CNTL  SKIP=0
OPTION   PRINT OFFSET=5,FLDLEN=2,VALUE=67FA,COND=E,E=DFSERA60
END
*-----------------------------------------------------------------*
/*
```

Example 9

This example shows the JCL and control statements required to print 67FF records from the IMS log.

```
//EXAMPLE9 JOB
//         EXEC PGM=DFSERA10
//STEPLIB  DD DSN=IMS.SDFSRESL,DISP=SHR
//SYSPRINT DD  SYSOUT=A
//LOGIN    DD  DISP=SHR,DSN=IMSLOG
//SYSIN    DD  *
CONTROL  CNTL  DD=LOGIN
OPTION  PRINT  O=5,T=X,V=67FF,L=2,C=M
OPTION  PRINT  O=29,T=X,V=F0F8F3F2,L=4,C=E,E=DFSERA30
END
```

Record Format and Print Module (DFSERA30)

Use the Record Format and Print Module (DFSERA30) to format trace and general purpose subrecord types (X'00' and X'01') and SNAP subrecord types (X'FD' and X'FF'). Other log records are formatted in z/OS dump format. DFSERA30 is an exit routine of the File Select and Formatting Print Utility (DFSERA10). Because this routine formats log records, it passes a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing.

For trace and SNAP subrecord types, the module creates log record leader information, followed by a formatted printout of each element within the log record.

DFSERA30 translates the STCK value in each record that is dumped into a human-readable date and time stamp, and prints this value on the record header line. Because this value is derived from the hardware clock, you should be aware of the following:

- The time is in UTC (GMT), not local time.
- The hardware clock does not include any leap second adjustments that may be present on your system (see CVT field CVTLSO). Thus, the time printed by DFSERA30 might be different from the time reported by z/OS when the record was written. The difference is equal to the leap second adjustment amount.

The Deadlock Report

The deadlock report contains information about the resources and resource owners for the following:

- Deadlocks resulting from 777 and 123 pseudoabends.
- Deadlocks in non-message-driven BMPs. (These result in an 'FD' status code.)

When DFSERA30 encounters this deadlock block, it prints the block and produces a report based on the data in the block. When excessive deadlocks occur, the deadlock block and the report based on it allow an analysis of the resources that are involved in the deadlock.

When IMS abends an application with a 777 or 123 pseudoabend due to an external subsystem detected deadlock, the deadlock report contains information to identify the subsystem, the job, and the unit of recovery that received the deadlock.

Figure 92 is an example of the DFSERA30 report for a simple deadlock involving a BMP region and an MPP region. The MPP program, which is waiting for resource 1 of 2, is chosen as the victim. It is requesting a root lock for key 'KK360'. The BMP

program is the holder of this lock. The BMP program is requesting a root lock for key 'KK130'. The MPP program is the holder of this lock.

```
DEADLOCK ANALYSIS REPORT - LOCK MANAGER IS IRLM


RESOURCE DMB-NAME LOCK-LEN LOCK-NAME     - WAITER FOR THIS RESOURCE IS VICTIM
01 OF 02 DHVNTZ02    08    00000BC4800501D7

KEY IS ROOT KEY OF DATA BASE RECORD ASSOCIATED WITH LOCK
KEY=(KK360)

       IMS-NAME TRAN/JOB PSB-NAME PCB--DBD PST# RGN  CALL LOCK  LOCKFUNC STATE
WAITER SYS3     NQF1     PMVAPZ12 DLVNTZ02 0002 MPP  GET  GRIDX 30400358  06-P
HOLDER SYS3     DDLKBMP1 PLVAPZ22 -------- 0003 BMP  ---- ----- --------  06-P



RESOURCE DMB-NAME LOCK-LEN LOCK-NAME
02 OF 02 DHVNTZ02    08    00000924800501D7

KEY IS ROOT KEY OF DATA BASE RECORD ASSOCIATED WITH LOCK
KEY=(KK130)

       IMS-NAME TRAN/JOB PSB-NAME PCB--DBD PST# RGN  CALL LOCK  LOCKFUNC STATE
WAITER SYS3     DDLKBMP1 PLVAPZ22 DLVNTZ02 0003 BMP  GET  GRIDX 30400358  06-P
HOLDER SYS3     NQF1     PMVAPZ12 -------- 0002 MPP  ---- ----- --------  06-P

DEADLOCK ANALYSIS REPORT - END OF REPORT
```

Figure 92. Deadlock Report for BMP Region and MPP Region

How to Read the Report

The formatted report is summarized by lock name. It begins with lock 1 of n, showing the database name being locked, the lock name length, and the lock name itself. The lock name is composed of codes that provide information about the lock such as its relative block address (RBA), whether the lock occurred in a Full Function (FF) or Fast Path (DEDB) database, and—in the case of a DEDB—whether the lock occurred at the control interval (CI) level or at the segment level.

In a FF database, the RBA is displayed in bytes 1–4 of the lock name. For example, in lock name `00000924800501D7`, the RBA= 924.

Determining the RBA of a lock in a FP database is slightly more complex. The lock name of a FP database is broken down as shown in Table 23:

Table 23. Lock Name In A FP Database

Byte Position	Lock Information
1	Lock ID
2-4	Relative Byte Address
5-6	DMCB Number
7	Area Number
8	Fast Path ID=C6

In a FP database, the first two digits (Byte 1) display the number ″80″ if the lock occurred at the segment level. In this case, the next three bytes displayed indicate the 30 bit RBA. You must multiply the *displayed* RBA by 4 to get the *true* RBA.

If the lock occurred at the CI level, the first two digits indicate the code X'00'. In this case, the next three bytes displayed indicate the 24 bit RBA. You must multiply the *displayed* RBA by 256 (X'100') to get the *true* RBA.

In addition, for any lock that occurred in a FP database, the last two digits (Byte 8) of the lock name display the code ″C6.″

For example, the lock name `80000C02800101C6` occurred in a FP database at the segment level with an RBA of '00003008'

In many cases, the lock is for a database record for which the root key is known. The next lines provide information about the root key for the database record being locked. The following are the possible report statements for the root key.

- `KEY IS ROOT KEY OF DATA BASE RECORD ASSOCIATED WITH LOCK`

  This statement is the most common. It indicates that the key that follows is the root key for the database record involved in the lock. You see this report statement, for example, when a HIDAM or PHIDAM root is retrieved using the index. The key is known when the lock on the root is requested.
- `KEY FOR RESOURCE IS NOT AVAILABLE`

  This statement indicates that the key for the database record being locked is not available. You see this report statement, for example, when a `GN` call for an HDAM or PHDAM database causes DL/I to lock the next root anchor. When this lock request is one of the resources involved in the deadlock, it is not possible to print the key associated with the lock.
- `LOCKING PRIOR ROOT FOR HIDAM ROOT INSERT, KEY DISPLAYED IS FOR NEXT HIGHER ROOT`

  This statement can occur when a root is inserted in HIDAM or PHIDAM and the root has twin forward and backward pointers. You see this report statement, for example, if the keys 10 and 12 are present and 11 is being inserted. The key displayed is key 12 but the lock is on key 10.
- `LOCKING ON NEXT HIDAM ROOT FOR GN CALL, KEY DISPLAYED IS FOR PRIOR HIDAM ROOT`

  This statement can occur when using HIDAM or PHIDAM with twin forward and backward pointing, and keys 10, 11, and 12 exist, and position is on key 10; a `GN` call requires a lock on 11. When the lock is required, the key is not known, so the key of the prior root is displayed.
- `LOCKING ON HDAM ANCHOR, KEY DISPLAYED IS HDAM KEY REQUESTED`

  This statement can occur when using HDAM or PHDAM. The item locked is the anchor. When the anchor is locked, the key that will be retrieved is not known but the key that is requested is known, and it is displayed.

The lock waiter and holder/owner information is printed next. Each waiting and holding work unit is identified by IMSID, tranname or jobname, PSB name, PST number, and region type. The WAITER listed is the work unit that the database key information pertains to.

There are some differences between the two lines of waiter and holder information. The current PCB name, the DL/I call, and the lock request pertains only to the waiter. This information is not available for the holder of the lock.

The current DL/I call being processed is reported as one of the following.

GET DL/I call was GU, GHU, GN, GHN, GNP, or GHNP. The captured information does not allow a breakdown of the specific GET call function.

REPL DL/I call was REPL.

ISRT DL/I call was ISRT or ASRT.

DLET DL/I call was DLET.

POS DL/I call was POS call on MSDB.

The lock request function is reported under the columns for LOCK and LOCKFUNC. The first byte of the LOCKFUNC is translated for convenience. The LOCKFUNC is the hexadecimal function, mode, state, and flags as mapped by the LRHPARM DSECT.

In the Figure 92 on page 310, X'30' is reported under LOCK as GRIDX. Familiarity and some understanding of DL/I locking terminology and data organizations is needed for a full understanding of the formatted deadlock information provided.

Related Reading: See *IMS Version 9: Administration Guide: Database Manager* for a description of locking.

The reason for translating the lock request function is to identify deadlocks caused by block level data sharing, by application programs accessing data in a different order, or mixtures of both. For deadlock purposes, the lock request functions can be summarized by the following:

GBID Get a block lock. Block level sharing only.

GZID Get a data-set-busy lock. Used only to serialize data set opens, closes, and extensions. Any involvement in a deadlock is probably an indication of an error in IMS code.

GXID Get a data-set-extend lock. Used to serialize the extending of a data set. Block level sharing only and probably a HISAM database.

GRID Get a lock on the root of a database record.

GQCM Get a Q command code lock. This is an application-originated lock on specific data. The GQCM function applies to full function only (Fast Path does not obtain a new lock when the Q command code is issued).

GSEG Get a segment lock for a dependent segment. This is not used when IRLM is the lock manager.

GFPLL Get a Fast Path lock.

The Lock States

The lock state is the type or level of lock and is usually designated by a number. To manage the lock states, IMS uses either the internal resource lock manager (IRLM) or the program isolation (PI) lock manager. These two lock managers do not use the same states to reflect the level of the locks. The PI lock manager supports four states and IRLM supports eleven, though IMS uses only eight of them.

Sometimes the lock states are referred to with names rather than numbers. The names used for the four PI-supported states are:

State 1 Read only

State 2 Read

State 3 Update

State 4 Exclusive

Table 24 is a matrix that describes the compatibility of the level of an incoming lock request and the level that the lock is held at when using the PI lock manager. A compatible state is indicated by a “C” (meaning that the lock request will be granted) and an incompatible state by an “X” (meaning that the lock request will not be granted).

Table 24. PI Lock Compatibility Matrix

Requested Level	1	2	3	4
Held at 1	C	C	C	X
Held at 2	C	C	X	X
Held at 3	C	X	X	X
Held at 4	X	X	X	X

The eight states provided by the IRLM and their characteristics are defined in two matrices. One is used to determine **resultant state** and the other to determine compatibility for a requesting and holding work unit.

The concept of a *resultant state* requires some explanation. In simple terms, the resultant state is the lock state that results from granting the current request or the ″held at″ state that a subsequent requestor will see assuming the current request is granted. Because the IRLM allows a resource to be locked more than once by a given work unit, when a work unit locks a resource for the second time and specifies a different state, the state in which the lock is finally held should be one that carries the privileges of the second state without losing those conferred by the first. Given a set of states with a strictly hierarchical privilege order, it would be sufficient to grant the higher of the two states. However, to allow a locking protocol in which each higher state does not necessarily include all the privileges of the preceding one, the matrix can specify that the resultant state is a third state that confers the sum of the privileges of the other two states. The request is then processed as a request for the third state. Table 25 is the resultant state matrix.

Table 25. IRLM Resultant State Matrix

Requested Level	1	2	3	4	5	6	7	8
Held at 1	1	2	3	4	5	6	7	8
Held at 2	2	2	3	4	5	6	7	8
Held at 3	3	3	3	6	5	6	7	8
Held at 4	4	4	6	4	5	6	7	8
Held at 5	5	5	3	5	5	6	7	8
Held at 6	6	6	6	6	6	6	7	8
Held at 7	7	7	7	7	7	7	7	8
Held at 8	8	8	8	8	8	8	8	8

The compatibility matrix is shown in Table 26 with compatibility indicated by a “C” and incompatibility by an “X”.

Table 26. IRLM Compatibility Matrix

Requested Level	1	2	3	4	5	6	7	8
Held at 1	C	C	C	C	C	C	C	X
Held at 2	C	C	C	C	C	C	X	X
Held at 3	C	C	C	X	X	X	X	X
Held at 4	C	C	X	C	C	X	X	X
Held at 5	C	C	X	C	X	X	X	X
Held at 6	C	C	X	X	X	X	X	X
Held at 7	C	X	X	X	X	X	X	X
Held at 8	X	X	X	X	X	X	X	X

For the IRLM, the state can have an attribute of *private*. The private attribute is only significant when using block level data sharing. The private attribute has no impact on granting locks to different threads of a single IMS. The private attribute indicates that the lock should be private (only granted) to this IMS.

Restriction: Any thread of another IMS sharing the data cannot be granted the lock.

Private is indicated with a '-P' following the lock state. In Figure 92 on page 310, the locks had the private attribute.

Special Situations

A fixed-size block is used to hold the data for each resource in the deadlock cycle. This block is large enough to hold the data for a cycle which involves nine resources. If the cycle involves more than nine resources a message indicates this and only the first nine are reported.

There are a limited number of blocks to hold the data. If all of the blocks are in use when a deadlock occurs, a message indicates this and no deadlock information is provided for that deadlock.

Additional Information Gathered

The formatted deadlock report is a summarization of the complete data gathered and snapped to the log. There are two macro DSECTs that map information in the *raw* data. These are the DIPENTRY DSECT and the DLKDLD DSECT.

Related Reading: See *IMS Version 9: Diagnosis Guide and Reference* for more information about these macros.

A Reporting Anomaly

There is one deadlock situation where the report is different.

```
LOCK 1                  LOCK 2
PST 1 owns STATE SHR    PST 2 owns STATE UPD
PST 3 waits STATE UPD   PST 1 waits STATE UPD
PST 2 waits STATE SHR
```

If application 3 on PST 3 had not interfered by asking for LOCK 1 at an incompatible state, there would have been no deadlock, because PST 2 is asking for LOCK 1 in a compatible state with the owner PST 1.

The anomaly that occurs in the reporting of this deadlock is that LOCK 1 is listed twice. It is listed once with PST 1 owning and PST 3 waiting, and it is listed again with PST 2 waiting and no holder information. The report displays NOTAVAIL in the IMS-NAME field for the HOLDER.

Selecting Only the Deadlock Block

Fewer elements are snapped on a 777 pseudo abend than for other pseudo abends; however, the snap does include more elements than the deadlock block. It is possible to select only a specific element from a snap. Figure 93 contains the DFSERA10 control statements to select only the deadlock element from any pseudoabend snap.

```
//SYSIN    DD *
*-------------------------------------------------------------------*
*                                                                   *
*      CONTROL STATEMENT : DEFAULTS                                 *
*                  INPUT = SYSUT1                                   *
*                 OUTPUT = SYSPRINT                                 *
*                                                                   *
*   SELECTION QUALIFIERS :                                          *
*            1. LOG RECORD TYPE OF X'67FF'                          *
*            2. NAME OF BLOCK WITHIN SNAP IS C'DEADLOCK'            *
*                                                                   *
*           EXIT ROUTINE = DFSERA30                                 *
*                                                                   *
*-------------------------------------------------------------------*
OPTION   PRINT  OFFSET=5,FLDLEN=2,FLDTYP=X,VALUE=67FF,COND=M
OPTION   PRINT  OFFSET=33,FLDLEN=8,FLDTYP=C,VALUE=DEADLOCK,COND=E,     X
                EXITR=DFSERA30
END
/*
```

Figure 93. Sample DFSERA10 Control Statements for Deadlock Element

IMS-Issued Subsystem Detected Deadlocks

When IMS abends an application with U777 because of an external subsystem detected deadlock, the Deadlock Report contains information to identify the subsystem, job, and Unit Of Recovery that received the deadlock.

Figure 94 is an example of the DFSERA30 report for a deadlock detected by an external subsystem.

```
PSEUDO ABEND RECORD  ABEND NO = 0777  RECNO = 00000162  TIME  12:24:07.1   DATE 1998.292
DEADLOCK

EXTERNAL SUBSYSTEM SSOP     DETECTED A DEADLOCK DURING NORMAL CALL
REGION TYPE   : MPP
REGION NUMBER : 0001
JOB NAME      : MPP1
PSB NAME      : DCSQL7B
SMB NAME      : TXSQL7B
RECOVERY TOKEN: E2E8E2F340404040000000000500000000
```

Figure 94. Deadlock Report for External Subsystem-Detected Lock

Utility Control Statements

Figure 95 on page 316 shows the control statements required to format type X'67' log records using the DFSERA30 exit routine.

```
Column 1     Column 10     Column 16                          72

CONTROL      CNTL
OPTION       PRINT         OFFSET=5,FLDLEN=2,                  X
                           VALUE=67aa,COND=E,                  X
                           EXITR=DFSERA30
END
```

Figure 95. Control Statements Required for DFSERA30

In this figure, aa is the log record subtype.

aa=01 Specifies TRACE log record subtype

aa=FD Specifies SNAP log record subtype

aa=FF Specifies ABEND log record subtype

Figure 96 shows a sample DFSERA30 output. AE9004 is the storage address of the LXB at the time the log record was created. The second column of each line is the relative offset from the LXB.

```
DFSERA30 -- FORMATTED LOG PRINT
.
.
.
INTERNAL TRACE RECORD
.
.
.
LXB
 AE9004   000000    807F0BC9  00093660    00AE9350  00AE92B0    00091E90  00AE991C   17000000  7F0C0000
 AE9024   000020    80000000  520821CE    0008229C  000820C6    80082194  012141CE   60000054  0A000000
 AE9044   000040    30000005  022140C6    600000CE  09000000    30000005  47000000   20000001  00000000
 AE9064   000060    00000000  00000000    00000000  00000000    00000000  00000000   00000000  00000000
 AE9084   000080  TO AE90C4   0000C0    SAME AS ABOVE
 AE90E4   0000E0    00000000  0C419317    F1044193  17F10441    9337E218  D243F510   A314A8C3  419101A2
 AE9104   000100    02F30C41  93179101    A502F004  F30C4193    17F10441  93170000   00000000  00B66218
```

Figure 96. Sample Formatted Log Print from DFSERA30

Program Isolation Trace Record Format and Print Module (DFSERA40)

The program isolation (PI) trace format and print module receives type X'67FA' log records as an exit routine from the File Select and Formatting Print utility (DFSERA10) and formats the records on the SYSPRINT data set.

Diagnosis, Modification, or Tuning Information

These log records are produced by the PI (program isolation) trace, trace PI enqueue and dequeue calls to DFSLRH00, and also by DL/I calls to the DL/I analyzer. The DL/I analyzer processes all DL/I calls. When tracing is active, the DL/I analyzer calls are traced. The standard ENQ/DEQ call is invoked by the DFSLR macro instruction.

End of Diagnosis, Modification, or Tuning Information

PI tracing is executed by the /TRACE command in an IMS online environment or by the OPTIONS statement with LOCK=OUT specified.

In a data sharing environment, if the PI trace is active and being logged, the PI trace logger is activated by the IMS lock manager (DFSLMGR0) and exits to the IRLM.

The PI Trace Record Format and Print module is loaded during the execution of the File Select and Formatting Print utility and must reside in the LINKLIB or in a JOBLIB or STEPLIB data set.

DFSERA40 Utility Control Statements

Figure 97 shows the control statements required for DFSERA40.

```
Column 1     Column 10     Column 16                        72

CONTROL      CNTL
OPTION       PRINT         OFFSET=5,FLDLEN=2,VALUE=67FA,     X
                           COND=E,EXITR=DFSERA40
END
```

Figure 97. Control Statements Required for DFSERA40

Output

Figure 98 on page 318 is a sample output from DFSERA40. The spacing of fields is altered.

Program Isolation Trace Record

```
DATE:    05/11/89
MODULE  PST   TIME (*=ET)  CALLR   ACT     LEV      WC  WFC   SEQN   FDBK   RC   PC  ID= (RBA   DMB DCB SUF) CLS  TOKEN   COMMENTS

LRH0    01                        GZIDB                     0ABE
LRH0    01                        RZIDP                     0AC1
PIEX    01    23:36:22.472   DLI  TNFQ    UPD      00  00   0AC3   0000           481075C5   8007  01

LRH0    01                        TTLKX                     0AC4
PIEX    01    23:36:22.472   DLI  ENQ     UPD      00  00   0AC5   0000           00000658   8006  01          00722050
LRH0    01                        GRICX                     0AC6
PIEX    01    23:36:22.474   APP  ENQ     SHR      00  00   0ACA   0000           00000694   8006  01      0   007220DC
LRH0    01                        GCCMX                     0ACB
DLA0    01    23:36:22.493        GU                        0ACE                          8                           DL/I CALL
PIEX    01    23:36:22.493   DLI  IDEC    UPD      00  00   0ACF   0000           00000658   8006  01
LRH0    01                        RRIOX                     0AD0
LRH0    01                        GZIDB                     0AC1
LRH0    01                        RZICB                     0AD4
PIEX    01    23:36:22.495   DLI  ENC     UPD      00  00   0AD6   0000           00001108   8006  01          00722050
LRH0    01                        GRICX                     0AD7
PIEX    01    23:36:22.496   DLI  IDEQ    UPD      00  00   0ADA   0000           00001108   8006  01
LRH0    01                        RRICX                     0ADB
DLA0    03    23:36:23.614        GU                        0ADE                          1                           DL/I CALL
LRH0    03                        GZIDB                     0AE4
LRH0    03                        RZICB                     0AE7
PIEX    03    23:36:23.735   DLI  TENQ    UPD      00  00   0AE9   0000           48107105   8007  01
LRH0    03                        TTLKX                     0AEA
PIEX    03    23:36:23.736   DLI  ENC     UPD      00  00   0AEB   0000           00000408   8006  01          00722050
LRH0    03                        GRIDX                     0AEC
PIEX    03    23:36:23.737   APP  ENQ     SHR      00  00   0AF0   0000           00000428   8006  01      0   00722014
LRH0    03                        GQCMX                     0AF1
DLA0    03    23:36:23.834        GU                        0AFS                          2                           DL/I CALL
PIEX    03    23:36:23.835   DLI  IDEQ    UPD      00  00   0AFA   0000           00000408   8006  01
LRH0    03                        FRIDX                     0AFP
LRH0    03                        GZIDB                     0AFC
LRH0    03                        RZIDB                     0AFF
PIEX    03    23:36:23.838   DLI  ENQ     UPD      00  00   0B01   0000           00001108   8006  01          00722050
LRH0    03                        GRICX                     0B02
PIEX    03    23:36:23.840   DLI  TDEQ    UPD      00  00   0B05   0000           00001108   8006  01
LRH0    03                        RRICX                     0B06
DLA0    02    23:36:27.257        GHU                       0B0F                          4                           DL/I CALL
PIEX    02    23:36:27.257   DLI  TDEQ    UPD      00  00   0B10   0000           0000087C   8006  01
LRH0    02                        RRICX                     0B11
LRH0    02                        GZIDB                     0B12
LRH0    02                        RZIDB                     0B15
PIEX    02    23:36:27.263   DLI  TENQ    UPD      00  00   0B17   0000           481071C5   8007  01
LRH0    02                        TTLKX                     0B18
PIEX    02    23:36:27.263   DLI  ENQ     UPD      00  00   0B19   0000           00000408   8006  01          007220A0
LRH0    02                        GRICX                     0B1A
PIEX    02    23:36:27.265   DLI  TENQ    UPD      01  00   0B1E   1800  04       00000428   8006  01          00722014
PIEX    03    23:36:45.079   APP  CEQ     SHR      00  00   0B34   0000                                    0
LRH0    03                        RQCML                     0B35
PIEX    02        0:17.850*  DLI  UNK     RD                0B37            6F                                      SEQ2=0B1E
LRH0    02                        TTLKL                     0B38        04
DLA0    02    23:36:45.982        GHU                       0B3A                          5                           DL/I CALL
PIEX    02    23:36:45.982   DLI  TDEQ    UPD      00  00   0B3B   0000           00000408   8006  01
LRH0    02                        RRICX                     0B3C
LRH0    02                        GZIDB                     0B3D

LRH0    02                        BZIDB                     0B40
PIEX    02    23:36:45.986   DLI  TENQ    UPD      00  00   0B42   0000           481075C5   8007  01
LRH0    02                        TTLKX                     0B43
PIEX    02    23:36:45.986   DLI  ENQ     UPD      00  00   0B44   0000           00000658   8006  01          007220A0
LRH0    02                        GRIDX                     0B45
```

Figure 98. Sample Output from DFSERA40

Explanation of Column Headings

DATE Specifies the date PI trace started. The TIME field is relative to this date.

MODULE
Specifies the module that issued the DFSLR call to DFSLRH00 or the module that called the IRLM or DFSFXC10. The four characters selected come from the xxxx portion of the full module name DFSxxxx0.

PST Specifies the program specification table (PST) number (from PSTPSTNR).

TIME Specifies the time of the call as HHH:MM:SS.UUU, where UUU is milliseconds, relative to the date on which tracing started. If the return code

(RC) is 04 and PI trace timing is active at the time of the call, the next record for this PST in this report shows the elapsed time of the enqueue wait in this field. The time is indicated as MM:SS.UUU*, with the "*" indicating it is an elapsed time.

CALLR
Specifies the type of caller (DLI, FP, APP).

ACT Specifies the action requested.

LEV Specifies the level of control for this call.

- **RD** Read only
- **SH** Share
- **UPD** Update
- **EXC** Exclusive

WC Number of PSTs that hold this resource in a state that caused this PST to wait.

WFC Number of PSTs waiting for this PST to release this resource.

SEQN Specifies the sequence number of the corresponding internal trace.

FDBK Is 2 bytes of feedback information from either DFSFXC10 or the IRLM.

RC Specifies the return code from DFSFXC10 or the IRLM.

- **00** Successful completion
- **04** Caller must IMS wait for control of the requested resource
- **08** Deadlock; request is disallowed. This transaction causes an internal pseudoabend, a backout, and automatic rescheduling.
- **0C** Invalid call

PC Specifies the PST post code following the enqueue wait. This field is only present when RC is 04 and the TIME field has an "*" at the end.

- **60** Deadlock occurred. This transaction causes an internal pseudoabend, a backout, and automatic rescheduling.
- **6F** Control of the resource has been obtained.

ID= Specifies an 8-byte identification of the resource being enqueued or dequeued. It contains a 4-byte RBA, a 2-byte DMB number, a 1-byte DCB number, and a 1-byte SUF (suffix) field.

CLS For APP types of callers, specifies the Q-command code class requested. For LMGR traces, specifies the CLASS parameter.

CLS applies to full function only (Fast Path does not support lock class).

TOKEN
Is the address of the control block enqueued or locked on this call or, if the type of call is an unlock or DEQ call, the address of the control block being passed to the lock manager.

COMMENTS
Specifies 'DL/I CALL' if a trace is requested from DFSDLA00. Other comments are for LMGR traces.

DL/I Call Image Capture Module (DFSERA50)

If trace data is sent to the IMS log data set, you can retrieve it using utility DFSERA10 and special DL/I call image capture routine DFSERA50. DFSERA50 deblocks, formats, and numbers the DL/I call image capture records to be retrieved. To use DFSERA50, insert a DD statement defining a sequential output data set in the DFSERA10 input stream. The default ddname for this DD statement is TRCPUNCH. The statement must specify BLKSIZE=80. You can distinguish between output from several BMP applications because the first three bytes of the trace entry sequence number are the PST number.

Utility Control Statements

The following examples of DFSERA10 input control statements in the SYSIN data set can be used to retrieve DL/I call image capture data from the log data set.

Print all DL/I call image capture records:

```
Column 1     Column 10

OPTION       PRINT OFFSET=5,VALUE=5F,FLDTYP=X
```

Print selected DL/I call image capture records by PSB name call:

```
Column 1     Column 10

OPTION       PRINT OFFSET=5,VALUE=5F,COND=M
OPTION       PRINT OFFSET=25,FLDTYP=C,FLDLEN=8,VALUE=psbname,COND=E
```

Format DL/I call image capture records (in format acceptable as input for the DL/I test program DFSDDLT0):

```
Column 1     Column 10

OPTION       PRINT OFFSET=5,VALUE=5F,COND=M
OPTION       PRINT EXITR=DFSERA50,OFFSET=25,FLDTYP=C,                x
                   VALUE=psbname,FLDLEN=8,DDNAME=OUTDDN,COND=E
```

Use the DDNAME= parameter to name the DD statement used by DFSERA50. The data set defined on the OUTDDN DD statement is used instead of the default TRCPUNCH DD statement. For this example, the DD appears as:

```
//OUTDDN DD ...,DCB=(BLKSIZE=80),...
```

IMS Trace Table Record Format and Print Module (DFSERA60)

The IMS trace table record format and print module (DFSERA60) is an exit routine. It receives type X'67FA' log records from the File Select and Formatting Print utility (DFSERA10) and formats the records on the SYSPRINT data set. These log records are produced when you use the OPTION statement for the DFSVSAMP data set or DFSVSMnn PROCLIB member to specify that trace table be written to the log.

DFSERA60 is loaded during execution of DFSERA10 and must reside in the LINKLIB or in a JOBLIB or STEPLIB data set.

Utility Control Statements

Figure 99 on page 321 shows the control statements required to invoke DFSERA60.

```
Column 1    Column 10     Column 16

CONTROL     CNTL
OPTION      PRINT         OFFSET=5,FLDLEN=2,VALUE=67FA,              x
                          COND=E,EXITR=DFSERA60
            END
```

Figure 99. Control Statements Required for DFSERA60

Enhanced Select Exit Routine (DFSERA70)

Use the Enhanced Select exit routine (DFSERA70) to:

- Produce expanded log records from compressed IMS logs.
- Select and format '5X' (DL/I 5X and fast path 5950) log records based upon data contained within the record itself, such as the contents of a time, date, or identification field. These records are formatted along with all log record types listed under the PARM TOKEN=description.
- Change the format of log output to identify and emphasize some optional log fields

You specify the search criteria for the routine as subparameters of the PARM= parameter of the OPTION statement for the File Select and Formatting Print utility (DFSERA10). For information about the syntax of the OPTION statement, see “OPTION Statement” on page 299. The possible subparameters of PARM= are:

XFMT=

Extends the X'50' log record format to enhance the retrievability of certain data entries.

Y Highlights the log data for certain types of processing by placing the data on a separate line and adding identifiers for data entries. It applies to log data that describes the following types of processing: data sharing, XRF buffer and lock tracking, space management, key, backout (undo), and recovery (redo). If a type of processing is not relevant, the data section is omitted.

These data sections are added after the raw log data for the record. Each section includes identifiers followed by hexadecimal log data, character log data, or both. They contain the following entries, where X represents hexadecimal log data and C represents character log data:

Data sharing

```
DSHRDSSN XXXXXXXX DSHRLSN XXXXXXXXXXXX DSHRUSID
XXXXXXXX RACF-UID CCCCCCCC XXXXXXXXXXXXXXXX
```

XRF buffer and lock tracking

```
TRAKPLSZ XXXX TRAKBUFN XXXX TRAKHASH XXXXXXXX
TRAKLOCK XXXXXXXX TRAKFLGS XX XX
```

Space management

```
SMGTFLGS XX XX SMGTROFF XXXX SMGTRLEN XXXX
```

Key

```
KSDS  Character string describing database action
LENGTH XXXX
One or more lines of mixed hexadecimal and character data
```

Undo

```
UNDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

Redo

```
REDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

N Does not highlight the log data for data sharing, buffer and lock tracking, space management, key, backout or recovery. The data is formatted as part of the raw data for the record.

N is the default.

PST=*pst_number*
Selects records for the PST number.

SYSID=*system_id*
Selects records for the system ID portion of recovery token.

TOKEN=*token*
Selects records for the hexadecimal token portion of recovery token. You can select the following record types: X'07', X'08', X'0A', X'13', X'27', X'28', X'31', X'32', X'35', X'37', X'38', X'39', X'3D', X'41', X'4C', X'50', X'56', X'59'X'5901', X'5903', X'5937', and X'5938'.

PSB=*psb_name*
Selects records for the PSB name.

DBD=*dbd_name*
Selects records for the DBD name.

RBA=*rba_value*
Selects records for the RBA (lrecl).

BLOCK=*block_rba*
Selects records for the RBA (block).

USERID=*userid*
Selects records for the userid.

KEY=*ksds_key*
Selects records for the key.

OFFSET=*offset*
Selects records that update a given offset of data in the buffer.

UNDO=*undo_data*
Selects records for backout data that matches the character string you specify. The maximum length of the character string is 255 characters.

REDO=*redo_data*
Selects records with recovery data that matches the character string you specify. The maximum length of the character string is 255 characters.

DATA=*log_data*
Selects records with data, including compressed data, anywhere in the record that matches (searches all log records). The maximum length of the character string is 255 characters.

Each subparameter must be uppercase and not have any blanks. The subparameter data must be character or decimal. Hexadecimal data must be preceded by an X and the data enclosed in single quotes (for example, X'0123').

Once the record is selected, it can be written to tape or DASD.

When multiple subparameters are specified, all conditions must be met to select a record. Use multiple routines to select records if some of the conditions have been met.

The log print formatting is done by DFSERA30. The format appears as if DFSERA30 was the routine specified. DFSERA30 must be available for DFSERA70 to load.

Unrecognized characters or invalid parameter specifications are ignored by this routine.

Examples of Using the Enhanced Select Exit Routine (DFSERA70)

This section includes examples of the use of DFSERA70.

Figure 100 shows the option for printing all records that includeX'50'/X'5950' database records and expanding the data in the X'5050' records.

```
OPTION  PRINT EXITR=DFSERA70
```

Figure 100. Example 1

Figure 101 shows the option for printing only X'50' database records with expanded data.

```
OPTION  PRINT O=5,V=50,EXITR=DFSERA70
```

Figure 101. Example 2

Figure 102 shows the option for printing X'50' database records with expanded data and 67 diagnostic records.

```
OPTION  PRINT O=5,V=67,EXITR=DFSERA30
OPTION  PRINT O=5,V=50,EXITR=DFSERA70
```

Figure 102. Example 3

Figure 103 shows the option for printing all records in regular format including X'50'/X'5950' database records for a PST number of X'A' using a PSB named APPLPSB.

```
OPTION  PRINT EXITR=DFSERA70,PARM=(XFMT=N,PST=X'A',PSB=APPLPSB)
```

Figure 103. Example 4

Figure 104 on page 324 shows the option for printing all records in regular format including X'50'/X'5950' database records at an RBA of X'2000' and an offset of X'200'.

Examples

```
OPTION  PRINT EXITR=DFSERA70,PARM=(XFMT=N,RBA=X'2000',OFFSET=X'200')
```

Figure 104. Example 5

Figure 105 shows the option for printing, in extended format, all records that contain the character string 'aaaa'.

```
OPTION  PRINT EXITR=DFSERA70,PARM=(XFMT=Y,DATA=aaaa)
```

Figure 105. Example 6

Figure 106 shows the option for selecting all types of log records with the token X'0001F8FF00000000' and printing the records in extended format.

```
OPTION  PRINT EXITR=DFSERA70,PARM=(XFMT=Y,TOKEN=X'0001F8FF00000000')
```

Figure 106. Example 7

Figure 107 shows the option for seleting X'0A' log records with the token X'0001F8E400000001' and printing the records in regular format.

```
OPTION  PRINT O=5,V=0A,T=X,EXITR=DFSERA70,PARM=(XFMT=N,TOKEN=X'0001F8E400000001')
```

Figure 107. Example 8

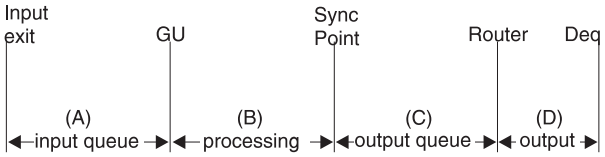
Chapter 14. Fast Path Log Analysis Utility (DBFULTA0)

Use the Fast Path (FP) Log Analysis utility to prepare statistical reports for Fast Path, based on data recorded on the IMS system log. This utility is an offline utility and produces three data sets, one of which contains six formatted reports:

- Detail Listing of Exception Transactions
- Summary of Exception Detail by Transaction Code for IFP Regions
- Overall Summary of Transit Times by Transaction Code for IFP Regions
- Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs
- Summary of Region Occupancy for IFP Regions by PST
- Summary of VSO Activity
- Recapitulation of the Analysis

These reports are useful for system installation, tuning, and trouble shooting. This utility is not related to the IMS Monitor or the Log Transaction Analysis utility.

Figure 108 shows four intervals that are computed for a Fast Path transaction:



(A) Input queue time—period from input exit to the get unique (GU) call of the application program

(B) Processing time—period from the get unique (GU) call of the application program to sync point

(C) Output queue time—period from sync point to entry to the output router

(D) Output time—period from output router entry to dequeue time

Figure 108. Intervals for a Fast Path Transaction

The maximum interval that can be recorded on the logs is 65.535 seconds. However, if in computing the time span to be reported, the fields overflow, then 9999 will be displayed on the report to indicate a computational overflow. The fields of IN-Q, PROC, and OUTQ can represent 9.999 seconds at maximum.

The four intervals are computed and inserted into reserved fields in Fast Path log records and are thus made part of the normal logging procedure. Intervals (A) and (B) appear in the input message (X'5901') and the output message (X'5903') log records respectively. Intervals (C) and (D) appear in the dequeue log record (X'5936'). Synchronization point takes place at the boundary between intervals (B) and (C).

The Fast-Path-Log-Analysis report includes additional performance-related data items from the Fast Path log records. The kinds of data items contained in the log records that may be reported are:

- Input message (X'5901') log record

  - The routing code for the transaction
  - The input terminal's LTERM name for the transaction
  - The balancing group queue count
- Synchronization point (X'5937') log record
  - The number of VSO reads
  - The number of VSO updates (CIs)
  - The number of ADS reads
  - The number of ADS updates (CIs)
  - The number of DEDB calls made
  - The number of MSDB calls made
  - The number of control interval (CI) contentions
  - The number of unit of work (UOW) contentions
  - The number of common buffers used
  - The number of waits for common buffers
  - The number of waits for private buffers

The intervals (A), (B), (C), (D), and the performance-related items are combined with other logged information to produce all the reports.

The following topics provide additional information:

- "Restrictions for DFBUTLA0"
- "Input and Output for DFBUTLA0" on page 327
- "Detail-Listing-of-Exception-Transactions Report" on page 328
- "Summary-of-Exception-Detail-by-Transaction-Code (for IFP Regions) Report" on page 333
- "Overall-Summary-of-Transit-Times-by-Transaction-Code (for IFP-Regions) Report" on page 334
- "Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs Report" on page 334
- "Summary-of-Region-Occupancy Report" on page 336
- "Summary-of-VSO-Activity Report" on page 337
- "Recapitulation-of-the-Analysis Report" on page 338
- "JCL Requirements for DFBUTLA0" on page 339
- "Utility Control Statements for DFBUTLA0" on page 340
- "Error Processing for DFBUTLA0" on page 345

Related Reading: You can use KBLA to build JCL and execute DBFULTA0. See "Using KBLA to Run a Job Against IMS Log Records" on page 508 for more information.

Restrictions for DFBUTLA0

The Fast Path Log Analysis utility cannot use Common Queue Server (CQS) logs as input because CQS log records have a different format from IMS log records.

Input and Output for DFBUTLA0

The Fast Path Log Analysis utility uses the following input:

- An IMS system log data set
- A control statement that contains the execution parameters

The Fast Path Log Analysis utility processing consists of the following two steps:

1. Constructing Fast Path transaction detail records (FPTDR)
2. Analyzing the FPTDRs and printing the reports

The basic unit of output from this utility is the FPTDR. One FPTDR is constructed for each Fast Path transaction processed. An FPTDR is a 143-byte EBCDIC logical record consisting of the data associated with a given transaction (compiled from one or more log records) and a sequence number that indicates the order in which this transaction entered sync-point processing. The last log record that can supply data for each FPTDR is the dequeue record for the transaction.

The basic FPTDR record is extended to 252 bytes when written to the Exception Traffic data set. The first 143 bytes are identical to the Total Traffic data set.

The Fast Path Log Analysis utility uses the FPTDRs to form the following three output data sets:

- Total Traffic, normally a tape or direct-access data set that contains every FPTDR. This data set can be passed to a subsequent job step for sorting and printing, or for additional analysis.

  This data set is optional.
- Exception Traffic, normally a direct-access or tape data set that contains only those FPTDRs that you have set as exceptional and that therefore appear in the Detail Listing of Exception Transactions report. This data set can be passed to a subsequent job step for sorting and printing, or for additional analysis.

  This data set is optional.
- Formatted Reports, normally a printer output data set that consists of several reports formed by various combinations of transaction detail records.

The Total Traffic and Exception Traffic data sets are provided to make it convenient for you to post process performance data, formatted by the utility, without using the log data set. For example, inspection of reports can indicate that the Total Traffic data set should be sorted and printed in physical line number and terminal sequence, to analyze a problem possibly related to line activity. An internal DSECT within the source code for DBFULTA0, `FPDR`, maps these records.

Records are written to the Total Traffic and Exception Traffic data sets in the order in which they are completed—in the order of dequeue records for the normal transaction sequence. However, the sequence number assigned for each transaction is determined by the order in which the transaction enters sync point processing.

Format of Total Traffic and Exception Traffic Data Sets

The Fast Path Log Analysis utility gathers the Fast Path transaction detail records that are written to the Total Traffic and Exception Traffic data sets. A single logical record is written for each FPTDR. The data set organization is fixed blocked, with LRECL=143 for SYSUT1 (the Total Traffic data set) and LRECL=252 for SYSUT2 (the Exception Traffic data set). The BLKSIZE can be specified in the `//SYSUT1` and

//SYSUT2 DD statements, however, the default blocking factor is 10. The logical records are written in order of the dequeuing record associated with each transaction. The data code is EBCDIC for all characters. The format of each logical record is mapped by internal DSECT FPDR.

All leading zeroes of the edited fields are suppressed; however, there is always at least a single nonblank digit to the left of a decimal point.

Fields that are unused (for example, the output time field of a record that has no dequeue information) are set to blanks.

The synchronization point date and IMS release level fields are included in the SYSUT1 and SYSUT2 data sets for informational purposes, but will not appear on formatted reports.

Decimal integer fields that contain overflow values are indicated by the value of all 9s. This method of indicating overflow causes overflowed fields to sort high.

Detail-Listing-of-Exception-Transactions Report

You define, with input parameters, what is considered to be an exceptional transit time value (TT input parameter) for each IFP transaction. Transit time is defined as the sum of intervals A, B, and C (defined in Figure 108 on page 325). Output time D is not included for this purpose. Any transaction with a transit time that exceeds the specified exceptional value is included in the Detail Listing of Exception Transactions and can be written on the SYSUT2 data set.

The following transactions are included in the report:

- Successfully processed IFP transactions with a transit time equal to or greater than the Exceptional Transit Time Specification.

  These include transactions for which a dequeue log record is not found. For these transactions the output queue time, and therefore the total transit time, are unknown and are not formatted. This condition is marked in the report by the characters NO DEQ under the TOTAL column.
- All IFP transactions with a synchronization point failure. These include invalid work prior to the first message GU and invalid work done after a message GU has received a ‘QC’ status code, or if the transaction returns to IMS without receiving a ‘QC’ status code.
- If you specify the “nonmessage” option, non-message-driven transactions are included.

You can limit the actual number of transactions reported with the MAXDETAIL input parameter. CALLS, BUFFER, and VSO lines are omitted for transactions that are not processed at the IMS for which the Fast Path Log Tape Analysis utility is run.

Figure 109 on page 329 is an example of a Detail-Listing-of-Exception-Transactions report.

```
DETAIL LISTING OF EXCEPTION TRANSACTIONS:                                                       PAGE   3


              LEGEND
              _________________________________________________________________
             |                                                                 |
             |    RT: REGION TYPE; I=IFP, M=MPP, B=BMP, D=DBCTL, U=UTILITY     |
             |    PT: PROCESS TYPE; H=HSSP, R=REORG                            |
             |    CONTENTIONS: CI; NO. OF WAITS FOR CI(S)                      |
             |                 UW; NO. OF WAITS FOR UOW (S)                    |
             |                 OB; NO. OF WAITS FOR OVERFLOW BUFFER LOCK       |
             |                 BW; NO. OF WAITS FOR COMMON BUFFERS             |
             |    SF: SYNC FAILURE CODES - SEE UTILITY REFERENCE MANUAL        |
             |    BUF USE: TOTAL BUFFERS USED FROM THE COMMON POOL - INCLUDES  |
             |        NBA, OBA AND NRDB (NON-RELATED BUFFERS FOR SDEP/MSDB USE)|
             |                                                                 |
              -----------------------------------------------------------------
DETAIL LISTING OF EXCEPTION TRANSACTIONS:                                                            PAGE   4

   SEQ  TRANCODE SYNC POINT  S ROUTING  LOGICAL  PST QUEUE TRANSIT TIMES(MSEC)- -OUT- DEDB ..ADS.. ..VSO.. MSDB BUF CONTENTIONS R P
   NO.   OR PSB     TIME     F  CODE    TERMINAL  ID COUNT IN-Q PROC OUTQ TOTAL (SEC) CALL  RD UPD  RD UPD CALL USE CI UW OB BW T T
_______ ________ ___________ _ ________ ________ ___ _____ ____ ____ ____ _____ _____ ____ ___ ___ ___ ___ ____ ___ __ __ __ __ _ _
      9 TPCA      3:55:38.00   TPCA     FPT05505  52   105   68   20   45   133   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
     58 TPCA      3:55:38.03   TPCA     FPT04203   8   113   73   38   41   152   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
      1 TPCA      3:55:38.00   TPCA     FPT07383  64   107   66   38   48   152   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
     25 TPCA      3:55:38.01   TPCA     FPT07447  46   104   70   23   36   129   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
     92 TPCA      3:55:38.06   TPCA     FPT05963  47   127   72   29   43   144   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
     88 TPCA      3:55:38.06   TPCA     FPT00939  15   124   67   50   45   162   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
    150 TPCA      3:55:38.09   TPCA     FPT02509  24   111   77   30   35   142   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
    148 TPCA      3:55:38.09   TPCA     FPT02570  13   110   79   40   37   156   0.1    5   3   1   4   2    0   5  0  0  0  0 I
        CALLS  - GU   0  GN   0  GNP   0  GHU   1  GHN   0  GHNP   0  REPL   1  ISRT   1  DLET   0  FLD   2  POS   0  TOTAL    5
        BUFFER - NBA=   4 OVFN=   0 STEAL=   0 WAIT=  0  OTHR=   1 NRDB=   1 PBUF=   0 PBWT=   0 ASIO=   0 AIOW=   0
        VSO    - VGET    4 VPUT    0 DGET    2
```

Figure 109. Sample Detail Listing of Exception Transactions

The column headings of the Detail-Listing-of-Exception-Transactions report are:

SEQ NO.
: Sequence in which this transaction entered sync point processing. Seven print positions are provided for this column; therefore, if there are more than 9999999 transactions during the specified analysis period, the sequence number wraps to 0.

TRANCODE OR PSB
: The transaction code, or PSB name.

SYNC POINT TIME
: The clock time at synchronization point processing.

S F
: Synchronization failure reason code character for transactions that fail synchronization processing. A nonblank character in this column indicates synchronization failure and, for this case, the following columns are blank. The meaning of nonblank codes A through U is as follows:

A MSDB verify failure

B MSDB arithmetic overflow

C DEDB sequential dependent area full

D DEDB sequential dependent insert caused buffer overflow

E DEDB sequential dependent buffer overflow three times

F DEDB area not available for use

G Dynamic MSDB area full

H MSDB required segment not found

I DEDB FLD calls; lock for a CI could not be obtained

J DEDB FLD calls; deadlock occurred

K DEDB FLD calls; overflow occurred

L ROLB call

M DEDB FLD calls; verify failed

N DEDB FLD calls; segment in CI was deleted

O Out of resources

P Inflight condition in /ERE

Q RESYNC abort requested

R Resource deadlock

S Out of space in data sets

U Application program abend

Information relating to sync failures is obtained from type X'5938' log records.

ROUTING CODE
Identification of the balancing group.

LOGICAL TERMINAL
The input LTERM name for this transaction.

PST-ID
The PST number.

QUEUE COUNT
The number of transactions in the balancing group (BALG) queue when this transaction entered synchronization point processing.

Transit Times in Milliseconds

IN-Q Time interval A, input queue time in milliseconds.

The input queue time will be marked N/A for Shared EMH input/output transit time when the transaction is:

1. Local only
2. Global only or local first transaction which is processed on other CPC while DBFULTA0 is reading the log of the IMS backend.

PROC Time interval B, processing time in milliseconds.

OUTQ Time interval C, output queue time in milliseconds. Information

relating to output queue time is obtained from type X'5936' log records, the terminal output dequeue records.

The input queue time will be marked N/A for Shared EMH input/output transit time when the transaction is:

1. Local only
2. Global only or local first transaction which is processed on other CPC while DBFULTA0 is reading the log of the IMS backend.

TOTAL
The sum of time intervals A, B, C. This is the transit time as defined for the utility. The magnitude of this sum exceeds the exception value for the transaction code.

OUT TIME
Time interval D, output time (to dequeue) in seconds.

DEDB CALL
The total number of DEDB calls.

ADS READS & UPDATES
The number of CIs read and updated.

VSO READS & UPDATES
The number of CIs read and updated from the data space.

MSDB CALL
The number of MSDB calls during this processing.

BUF USE
The total number of buffers used from the common buffer pool. This number includes non-related buffers used for MSDBs and SDEPs.

CONTENTIONS

CI The number of waits for CIs during this processing.

UW The number of waits for UOWs during this processing.

OB The number of waits for overflow buffer allocation. This number should never be greater than 1.

BW The number of waits for common buffers.

RT The region type, one of the following:

B BMP

I IFP

M MPP

U Utility

PT The process type, one of the following:

G Shared EMH global message processing

H HSSP

R Reorganization

The following lines are only obtained if the optional utility control statements are provided. However, the information is always available in the extension to the FPTDR record in the SYSUT2 data set.

CALLS Line

The CALLS line contains the number of DL/I calls by type for DEDB calls. Information relating to CALLS is obtained from type X'5937' log records.

The different types of DL/I calls are:

GU CALL The number of GU calls

GN CALL The number of GN calls

GNP CALL The number of GNP calls

GHU CALL The number of GHU calls

GHN CALL The number of GHN calls

GHNP CALL The number of GHNP calls

REPL CALL The number of REPL calls

ISRT CALL The number of ISRT calls

DLET CALL The number of DLET calls

FLD CALL The number of FLD calls

POS CALL The number of POS calls

TOTAL The number of DL/I calls during this processing

BUFFER Line

The BUFFER line contains the amount of buffer use by type. Information relating to BUFFER is obtained from type X'5937' log records:

The different types of buffer use are:

NBA The number of times a wait for NBA latch occurred during this processing.

OVFN The number of overflow buffers used during this processing.

STEAL The number of times buffer stealing is invoked by this transaction.

WAIT The number of times the transaction waited for a buffer to become available.

OTHR The number of buffers sent to OTHREAD.

NRDB The number of buffers used by MSDB and SDEP processing.

PBUF The number of private buffers used by HSSP or the High Speed DEDB Direct Reorganization utility in a transaction (one unit of work).

PBWT The number of waits for private buffers by HSSP or the High Speed DEDB Direct Reorganization utility in a transaction (one unit of work).

ASIO The number of UOW asynchronous read-aheads by HSSP or the High Speed DEDB Direct Reorganization utility in a transaction (one unit of work).

AIOW The number of UOW asynchronous read-aheads to complete by HSSP or the High Speed DEDB Direct Reorganization utility in a transaction (one unit of work).

This number should be either zero or one.

VSO Line

The VSO line contains information on data space use by transaction. Information relating to VSO is obtained from type X'5937' log records.

The type of information collected about data space use is as follows:

VGET The number of CI read requests satisfied from a data space.

VPUT The number of CIs with updates to a data space.

This number represents the number of CIs that would have been sent to OTHREAD if the areas were non-VSO.

DGET The number of CIs read from DASD into a data space.

SEMHB Line

The SEMHB line contains the transit time for Fast Path input and output messages on EMHQ. Information relating to SEMHB is obtained from type X'5936' log records.

The type of information collected about data space use is as follows:

SHARED EMHB
Shared EMH global message processing.

IMSG TRANSIT
The time that a Fast Path input message spent on the EMHQ before an application GU. The time is in milliseconds.

OMSG TRANSIT
The time that a Fast Path output message spent on the EMHQ before an application GU. The time is in milliseconds.

You can specify exceptional transit time values separately for each Fast Path transaction code. A global value can be specified that applies to all other unspecified transaction codes.

Summary-of-Exception-Detail-by-Transaction-Code (for IFP Regions) Report

A summary is produced for the exceptional transactions selected for the Detail Listing of Exception Transactions. However, only the exceptional IFP transactions are taken into account. None of the other transaction types are included even if the NON-MESSAGE option is specified.

Transactions for which a dequeue record was not found are not included in this summary.

Figure 110 on page 334 is an example of the Summary-of-Exception-Detail-by-Transaction-Code report.

Exception Detail by Transaction Code Report

```
SUMMARY OF EXCEPTION DETAIL BY TRANSACTION CODE FOR IFP REGIONS                                                    PAGE   6
                    -------------- TRANSIT TIMES IN MILLI-SECONDS --------------    INPUT  MSG    OUTPUT MSG
TRANS      -NO.OF-   ----TOTAL---    --INPUT Q --    --PROCESS --    --OUTPUT Q--    LENG  (CH)    LENG (CH)-
CODE       -TRANS-   -AVG-  -MAX-    -AVG-  -MAX-    -AVG-  -MAX-    -AVG-  -MAX-    -AVG  -MAX    -AVG  -MAX
________   _______   _____  _____    _____  _____    _____  _____    _____  _____    ____  ____    ____  ____
TPCA        157837     381    889      293    682       40    405       47    325      94    94      100   100
```

Figure 110. Sample Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs

The column headings for this report are:

TRANS CODE
The transaction code.

NO. OF TRANS
The number of occurrences of the transaction code for which a transit time value was computed.

TRANSIT TIMES
The average and maximum values of transit time intervals in milliseconds.

LENG OF INPUT
The average and maximum values of input message length.

LENG OF OUTPUT
The average and maximum values of output message length.

The averages are computed using the number of occurrences of the transaction code for which a transit time value was computed.

Overall-Summary-of-Transit-Times-by-Transaction-Code (for IFP-Regions) Report

A summary report is produced, by transaction code, for all IFP transactions found for the analysis period. Transactions for which a dequeue record was not found are not included in the summary.

The format of this report is identical to that of the Summary of Exception Detail by Transaction Code for IFP Regions. Figure 111 is an example of the Overall Summary of Transit Times by Transaction Code for IFP Regions.

```
OVERALL SUMMARY OF TRANSIT TIMES BY TRANSACTION CODE FOR IFP REGIONS:                                              PAGE   7
                    -------------- TRANSIT TIMES IN MILLI-SECONDS --------------    INPUT  MSG    OUTPUT MSG
TRANS      -NO.OF-   ----TOTAL---    --INPUT Q --    --PROCESS --    --OUTPUT Q--    LENG  (CH)    LENG (CH)-
CODE       -TRANS-   -AVG-  -MAX-    -AVG-  -MAX-    -AVG-  -MAX-    -AVG-  -MAX-    -AVG  -MAX    -AVG  -MAX
________   _______   _____  _____    _____  _____    _____  _____    _____  _____    ____  ____    ____  ____
TPCA        157837     381    889      293    682       40    405       47    325      94    94      100   100
```

Figure 111. Sample Overall Summary of Transit Times by Transaction Code for IFP Regions

Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs Report

A summary report is produced for all transactions and PSBs that had their synchronization point processing during the interval specified for the analysis. These include successfully processed and failed transactions from MPP, BMP and utility regions, and DBCTL threads. Data is summarized by PSB name or transaction code.

Figure 112 is an example of the Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs.

```
OVERALL SUMMARY OF RESOURCE USAGE AND CONTENTIONS FOR ALL TRANSACTION CODES AND PSBS:                                    PAGE   8
TRANCODE --NO.-- ------DEDB CALLS------- -MSDB-- ----ADS I/O---- ----VSO ACT---- -COMMON BUFFER- TOTL CONTENTIONS TRAN LGNR STATS
--OR---- ---OF-- -TOTAL- --GET-- --UPD-- -CALLS- --RDS-- --UPD-- --RDS - --UPD-- -----USAGE----- SYNC TOT TOT CI/ RATE -NO. OF CI
--PSB--- -TRANS- AVG MAX AVG MAX AVG MAX AVG MAX AVG MAX AVG MAX AVG MAX AVG MAX AVG MAX WTS STL FAIL UOW OBA SEC /SEC COMB LOG'D

________ _______ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ____ ____ ____ ____ _____
TPCA      157837   5   5   1   1   2   2   0   0   3   3   1   1   4   4   2   2   5   5   0   0    0   0   0 106 1315    0     0
```

Figure 112. Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs

The column headings of this report are:

TRANCODE OR PSB
The transaction code or PSB.

NO. OF TRANS
The number of occurrences of the transaction code for which a transit time value was computed.

DEDB CALLS
The number of DEDB calls

TOTAL
The total number of DL/I calls during this processing

GET The total number of "GET" DL/I calls during this processing (GU, GN, GNP, GHU, GHN, GHNP)

UPD The total number of "UPDATE" DL/I calls during this processing (REPL, ISRT, DLET, FLD)

AVG The average number of calls per processing interval

MAX The maximum number of calls per processing interval

MSDB CALLS (AVG MAX)
The average and maximum numbers of MSDB calls per processing interval.

ADS I/O
The area data set I/O

RDS The total number of "READ" DL/I calls (GU, GN, GNP, GHU, GHN, GHNP) during this processing for an area data set

UPD The total number of "UPDATE" DL/I calls (REPL, ISRT, DLET, FLD) during this processing for an area data set

AVG The average number of calls per processing interval

MAX The maximum number of calls per processing interval

VSO ACT
The amount of VSO activity

RDS The total number of CI read requests satisfied from a data space

UPD The total number of CIs with updates to a data space

AVG The average number of calls per processing interval

MAX The maximum number of calls per processing interval

COMMON BUFFER USAGE
The amount of buffer usage

AVG The average number of calls per processing interval

MAX The maximum number of calls per processing interval

WTS The total number of times a transaction waited for a buffer to become available

STL The total number of times buffer stealing was invoked for the transaction

TOTL SYNC FAIL
The total number of occurrences of this transaction code that failed synchronization point processing.

CONTENTIONS
The number of control interval contentions

TOT UOW
The total number of times unit-of-work contentions occurred for this transaction code

TOT OBA
The total number of times overflow buffer area contentions occurred for this transaction code

CI/SEC
The total number of CI contentions per second for this transaction code.If the time interval is less than one second, then it will default to one second

TRAN RATE/SEC
The average transaction rate for this transaction code. If the time interval is less than one second, then it will default to one second

LGNR STATS
The statistics related to the LGNR specification

Related Reading: For more information on the LGNR specification, see *IMS Version 9: Installation Volume 2: System Definition and Tailoring*.

NO. OF CI COMB
The total number of times the LGNR specification was exceeded for this transaction code. This number is either `0` or `1`.

NO. OF CI LOG'D
The total number of times an entire CI was logged for this transaction code. This number is either `0` or `1` and will only be `1` if `NO. OF CI COMB` is also `1`.

Summary-of-Region-Occupancy Report

A summary report is produced of approximate region occupancy for IFP regions during a specified period of time. If the time interval is less than one second, then it will default to one second. This information can be used to determine if an appropriate number of IFP regions are available for processing the workload.

This report is generated only if both the START and END parameters are specified for the utility. Figure 113 on page 337 is an example of this report.

```
SUMMARY OF REGION OCCUPANCY (PERCENT) FOR IFP REGIONS BY PST                                                    PAGE   9

     MEASUREMENT INTERVAL=    120 SECONDS.

REGION   1 HAD 70% OCCUPANCY WITH  84.4 SEC OF TOTAL PROCESS TIME DURING    978  TRANSACTIONS. RELATED PSB=TPC
REGION   2 HAD 67% OCCUPANCY WITH  81.1 SEC OF TOTAL PROCESS TIME DURING    922  TRANSACTIONS. RELATED PSB=TPC
REGION   3 HAD 68% OCCUPANCY WITH  82.2 SEC OF TOTAL PROCESS TIME DURING    956  TRANSACTIONS. RELATED PSB=TPC
REGION   4 HAD 67% OCCUPANCY WITH  81.3 SEC OF TOTAL PROCESS TIME DURING    926  TRANSACTIONS. RELATED PSB=TPC
REGION   5 HAD 69% OCCUPANCY WITH  83.4 SEC OF TOTAL PROCESS TIME DURING    972  TRANSACTIONS. RELATED PSB=TPC
REGION   6 HAD 67% OCCUPANCY WITH  80.7 SEC OF TOTAL PROCESS TIME DURING    919  TRANSACTIONS. RELATED PSB=TPC
REGION   7 HAD 70% OCCUPANCY WITH  84.1 SEC OF TOTAL PROCESS TIME DURING    978  TRANSACTIONS. RELATED PSB=TPC
REGION   8 HAD 68% OCCUPANCY WITH  82.5 SEC OF TOTAL PROCESS TIME DURING    942  TRANSACTIONS. RELATED PSB=TPC
REGION   9 HAD 66% OCCUPANCY WITH  80.4 SEC OF TOTAL PROCESS TIME DURING    944  TRANSACTIONS. RELATED PSB=TPC
REGION  10 HAD 70% OCCUPANCY WITH  84.8 SEC OF TOTAL PROCESS TIME DURING    958  TRANSACTIONS. RELATED PSB=TPC
```

Figure 113. Sample Summary of Region Occupancy (Percent) for IFP Regions by PST

Summary-of-VSO-Activity Report

A summary report is produced of VSO performance statistics by area. This report is generated only if there have been writes to the disk.Figure 114 is an example of this report.

```
SUMMARY OF VSO ACTIVITY                                    PAGE  12

 SHR(0/1)    VSO        VSO        DASD       DASD       I/O
  AREA       GETS       PUTS       GETS       PUTS       SCHED
_________  _________  _________  _________  _________  _________

BRANCH01       8092       8095          0       6012       2154
TELLER01       8200       8198          0       8018       3752

 SHR(2/3)     CF         CF      READ  READ   DASD       DASD
  AREA       GETS       PUTS     HIT    XI    GETS       PUTS
_________  _________  _________  ____  ____  _______  _________

AREAFR01   1234567    1234567    99%   99%  1234567   1234567
AREA2      1234567    1234567    N/A   N/A  1234567   1234567
```

Figure 114. Sample Summary of VSO Activity

The column headings of the Summary-of-VSO-Activity report are:

VSO GETS
The total number of CI read requests satisfied from a data space.

VSO PUTS
The total number of CIs with updates to a data space. This number is the total number of CIs that would have been sent to OTHREAD if the areas were non-VSO.

DASD GETS
The number of CIs read from DASD into a data space.

DASD PUTS
The number of CIs written from a data space to DASD.

I/O SCHED
The total number of I/Os scheduled.

CF GETS
The total number of CI read requests satisfied by a coupling facility.

CF PUTS
The total number of CIs with updates to a coupling facility.

READ-HIT
The percentage of searches of the pool and the number of times that buffers were found. This is only valid for a lookaside pool.

READ-XI
The percentage of times a buffer was found in the pool and the number of times the buffer was invalid. This is only valid for a lookaside pool.

DASD GETS
The number of CIs read from DASD into the coupling facility.

DASD PUTS
The number of CIs written from the coupling facility to DASD.

Recapitulation-of-the-Analysis Report

Figure 115 is an example of the Recapitulation of the Analysis.

```
RECAPITULATION OF THE ANALYSIS:                                          PAGE  13



     (1) TOTAL NUMBER OF FAST PATH TRANSACTIONS EXAMINED (SYSUT1).................157837
     (2) NO. OF TRANSACTIONS INCLUDED IN THE EXCEPTION DETAIL DATA SET (SYSUT2)...157837
                    BREAKDOWN BY EXCEPTION TYPE:
                         (2.1) TRANSIT TIME.....................157837
                         (2.2) IFP SYNC FAILURE.....................0
                         (2.3) NO DEQUEUE RECORD....................0
                         (2.4) MPP,BMP, DBCTL AND UTILITIES.......N/A
                               (INC SYNC FAILURE)
     (3) NO. OF IFP TRANSACTIONS INCLUDED IN THE SUMMARY OF
                    EXCEPTION DETAIL BY TRANSACTION (2.1)+(2.2)...................157837
     (4) NO. OF TRANSACTIONS OR PSBS INCLUDED IN THE PROFILE SUMMARY
                    FOR ALL REGIONS (INC SYNC FAILURE) BY PSB OR TRANCODE.........157837
     (5) NO. OF IFP TRANSACTIONS INCLUDED IN THE OVERALL SUMMARY
                    BY TRANSACTION (1)-(2.3).....................................157837
     (6) NO. OF TIMES COMBINING CONSTANT WAS DOUBLED..................................0
     (7) NO. OF TIMES ENTIRE CI LOGGED (LGNR EXCEEDED)...............................0
```

Figure 115. Sample Recapitulation of the Analysis

The meanings of the headings are as follows:

Line (1)
Number of transactions in the analysis period that were examined and selected as a basis for the statistical data reported by the utility. These include any transactions that were involved with Fast Path resources, that is, from IFP, MPP, or BMP regions, or from DBCTL transactions. These are also the transactions written to the total traffic output data set if the SYSUT1 DD statement was provided.

Line (2)
Number of exceptional transactions found and written to the SYSUT2 data set. These include:

- IFP transactions with a transit time equal or greater than the Exceptional Transit Time Specification
- All IFP transactions with a sync point failure
- All IFP transactions for which no dequeue records were found
- All non-message-driven Fast Path transactions if the option NON-MESSAGE was selected by the user. These include MPP, BMP, utility, and DBCTL transactions.

Line (2.1)
Number of IFP transactions with a transit time equal or greater than the Exceptional Transit Time Specification. The number must match the number of transactions reported in the column NO. OF TRANS of the Summary-of-Exception-Detail-by-Transaction-Code-for-IFP report.

Line (2.2)
Number of IFP transactions with a synchronization point failure. The number must match the number of transactions reported in the column SYNC FAIL of the Summary of Exception Detail by Transaction Code for IFP Regions.

Line (2.3)
Number of IFP transactions in the analysis period for which dequeue records were not found.

Line (2.4)
Number of non-message-driven Fast Path transactions. These include all transactions from MPP, BMP and utility regions, and from DBCTL threads found in the analysis period. This is reported only if the NON-MESSAGE option was selected.

If the NON-MESSAGE option is not selected, the N/A (not applicable) characters are printed.

Line (3)
Number of IFP transactions as reported by the Summary of Exception Detail by Transaction Code for IFP Regions. The number includes successfully processed transactions and transactions with a synchronization point failure. It is the sum of the numbers reported in lines (2.1) and (2.2). It does not include transactions for which no dequeue records were received.

Line (4)
Number of transactions included in the Overall Summary of Resource Usage and Contentions for All Transaction Codes and PSBs report. The number must match the number in line (1).

Line (5)
Number of transactions included in the Overall Summary of Transit Times by Transaction Code for IFP Regions. The number must match the number of transactions reported in the NO. OF TRANS column.

Line (6)
Total number of times the LGNR specification was exceeded for all transaction codes.

Related Reading: Refer to *IMS Version 9: Installation Volume 2: System Definition and Tailoring* for an explanation of the LGNR specification.

Line (7)
Total number of times the entire CI was logged for all transaction codes.

JCL Requirements for DFBUTLA0

EXEC
Executes the Fast Path Log Analysis utility.

```
//EXEC PGM=DBFULTA0
```

DD Statements

STEPLIB DD
Describes the program library that contains the DBFULTA0 load module.

```
//STEPLIB DD DSN=IMS.SDFSRESL,DISP=SHR
```

SYSPRINT DD

Describes the data set that receives the printed output of DBFULTA0—reports, messages, and parameter statement images. This DD statement is required.

```
//SYSPRINT DD SYSOUT=A
```

SYSUT1 DD

Describes the data set that receives the total traffic output of DBFULTA0. This is a sequential data set consisting of every Fast Path transaction detail record formed by DBFULTA0. Each record is in EBCDIC characters. The logical record length is 143 bytes. The block size specification is optional. The default value for BLKSIZE is 1430.

```
//SYSUT1    DD DSN=&&TOTAL,DISP=(,PASS),UNIT=SYSDA,
//             SPACE=(CYL,(1,1)),DCB=BLKSIZE=2860
```

SYSUT2 DD

Describes the data set that receives the exception traffic output of DBFULTA0. This is a sequential data set consisting of the Fast Path transaction detail records that are exceptions. It is a copy of the Detail Listing of Exception Transactions with headings and carriage control characters suppressed. The logical record length is 252 bytes. The block size specification is optional. The default value of BLKSIZE is 2520.

```
//SYSUT2    DD DSN=&&EXCEP,DISP=(,PASS),UNIT=SYSDA,
//             SPACE=(CYL,(1,1)),DCB=BLKSIZE=5040
```

LOGTAPE DD

Describes the input log data set. This must be the log file from IMS V5.

```
//LOGTAPE   DD DSN=IMS33.LOG,DISP=OLD,VOL=SER=XXXXXX,UNIT=XXXX
```

SYSIN DD

Describes the input control data set. This data set is used to specify execution parameters. This DD statement is optional. The following is a sample input stream.

```
//SYSIN DD *
START=09:59:59          24-hour notation, note colons
END=12:00:00
LINECNT=45              lines per page for reports
NOT-MESSAGE             include transactions that are not IFPs
MAXDETAIL=5000          exceptions detail listing limit
CALLS
BUFFER
VSO
TT(*)=15.0
TT(TCODE1)=3.0
TT(TCODE2)=2.5
TT(TCODE3)=1.0
```

Utility Control Statements for DFBUTLA0

Control statements in the SYSIN data set control the Fast Path Log Analysis utility. You can specify the time period of Fast Path execution for which the analysis is to be performed. This is expressed as the starting time (clock time) or an ending time. Transactions whose synchronization point time stamps fall within this interval are processed. If you do not specify an interval, the entire log data set is processed.

After the log is processed up to the end time specified, scanning continues to find dequeue records related to transactions that were processed during the specified analysis time interval.

Process multi-volume log data sets by specifying multiple volumes in the //LOGTAPE DD statement or by concatenation of DD statements.

Transit Time Exception Specification

You can limit the volume of printed output produced by specifying an exceptional transit time value for each transaction code. Occurrences of transaction transit times that are less than the exceptional value do not appear in the Detail Listing of Exception Transactions. You can specify a different exception transit time for each unique transaction code. Also, you can specify a global value for all transaction codes that are not individually specified. A separate summary report is produced for those transactions that exceed the exception criteria.

A detail report of all the transactions processed from the log data set can be produced either by not specifying an exceptional transit time (default=0) or by printing the total FPTDR data set in a subsequent job step.

An upper limit can be placed on the number of transactions that are printed in the Detail-Listing-of-Exception-Transactions report. This limit can be used to prevent the production of unexpectedly large output listings.

Analysis Parameter Statement Formats

All statements begin in column 1. The statements can appear in any order and are listed in the SYSPRINT data set for verification.

Starting Date Specification (STARTDAY)

You can specify the date of the earliest transaction to be processed in Julian format. Transactions with an earlier date are ignored. If the starting time is also specified, transactions with an earlier synchronization point time on that day are also ignored. The format of this parameter is:

```
STARTDAY=YYDDD
```

YYDDD is the last two digits of the year and the sequential number of the day, running from 1 to 366.

The default value is the date IMS was started, from the type X'42' log record.

Ending Date Specification (ENDDAY)

You can specify the date of the latest transaction to be processed in Julian format. Transactions with a later date are ignored. If the ending time is also specified, transactions with a later synchronization point time on that day are also ignored. The format of this parameter is:

```
ENDDAY=YYDDD
```

(last two digits of the year and the sequential number of the day, running from 1 to 366)

The default value, if ending time is specified, is the date IMS was started from the type X'42' log record. If ending time is less than starting time, the default is one day later. If neither ending date nor ending time are specified, the entire data set is processed.

Starting Time Specification (START)

You can specify the time of the earliest transaction to be processed. Transactions with an earlier sync-point time are ignored. The format of this parameter is:

```
START=HH:MM:SS[{+|-}HH:MM]
```

(in hours, minutes, and seconds for a 24-hour clock). You only need to specify the optional time-zone information if the offset to the Universal Time Coordinated on the day entered is different from the current offset, for example because of a daylight savings time change.

The optional time-zone information following hh:mm:ss contains the following:

+ or - Specifies the sign of the time-zone offset from UTC.

HH Specifies the number of whole hours of offset from UTC.

MM Specifies minutes of offset. MM can be 00, 15, 30, 45, or blank.

The default value is 00:00:00, which causes the analysis to begin with the first transaction on the log data set.

Ending Time Specification (END)

You can specify the sync-point time of the latest transaction to be processed. Transactions with a later synchronization point time will be ignored. The format of this parameter is:

```
END=HH:MM:SS[{+|-}HH:MM]
```

(in hours, minutes, and seconds for a 24-hour clock). You only need to specify the optional time-zone information if the offset to UTC on the day entered is different from the current offset, for example because of a daylight savings time change.

The optional time-zone information following hh:mm:ss contains the following:

+ or - Specifies the sign of the time-zone offset from UTC.

HH Specifies the number of whole hours of offset from UTC.

MM Specifies minutes of offset. MM can be 00, 15, 30, 45, or blank.

If the end date is not specified, the default value causes the analysis to end with the last transaction on the log data set.

The date on the log data set is not explicitly specified by a parameter statement. The data is implicit with the specification for the log data set that is in the JCL Requirements section. The Julian date is read from the log header record when execution begins, and this date is printed as part of the parameter summary for verification.

Exceptional Transit Time Specification (TT)

You can specify a time interval for each Fast Path transaction that you decide to consider exceptional for reporting purposes. The format of this parameter is:

```
TT (TRANCODE)=SS.T
```

(in seconds and tenths of seconds)

The transaction code, up to eight characters, is enclosed in parentheses. You can specify as many as 100 individual transaction codes. A global value of exceptional transit time is specified as follows: `TT(*)=SS.T` (in seconds and tenths of seconds).

This value applies to all transaction codes that are not individually specified. Individual specification overrides the global value. The default value for the global exceptional transit time is 0. A practical upper limit of exceptional transit time is 65.5 seconds. This limitation results from the field size used to express the time intervals (A), (B), and (C) in the Fast Path log records.

Not Message-Driven Option (NON-MESSAGE or NOT-MESSAGE)

You can specify that transactions that are not IFPs (that is, BMPs, MPPs, utilities and DBCTL threads) should be considered exceptions and be included in the Detail-Listing-of-Exception-Transactions report. The accepted formats are:

```
NON-MESSAGE
```

or

```
NOT-MESSAGE
```

NOT-MESSAGE means transactions are not IFPs.

Detail-Listing-of-Exception-Transactions Report Size Limitation (MAXDETAIL)

You can limit the number of lines printed in the Detail Listing of Exception Transactions. After this limit is reached, the analysis continues; however, no further transactions are printed in the Detail Listing of Exception Transactions.

The format of this parameter is:

```
MAXDETAIL=n
```

where n is an integer of no more than seven digits. The default value is 1000. The limitation of printed output lines does not affect the number of exception detail records that are written to the exception detail traffic data set (SYSUT2).

DL/I Call Specification (CALLS)

You can specify that the number of DL/I calls be printed. They are printed by call type (`GU`, `REPL`, and so on). The format of this parameter is:

```
CALLS
```

Information about calls is obtained from type X'5937' log records.

Buffer Use Specification (BUFFER)

You can specify that the amount of buffer use, by type, be printed. The format of this parameter is:

```
BUFFER
```

The type of information collected about buffer use is as follows:

- The number of NBA buffers used (NBA)
- The number of overflow buffers used (OVFN)
- The number of times buffer stealing was invoked by this transaction (STEAL)
- The number of times the transaction waited for a buffer to become available (WAIT)

- The number of buffers sent to OTHREAD (OTHR)
- The number of buffers used by MSDB and SDEP processing (NRDB)

Information about buffer use is obtained from type X'5937' log records.

Data Space Use Specification (VSO)

You can specify that information on data space use, by transaction, be printed. The format of this parameter is:

```
VSO
```

The type of information collected about data space use is as follows:

- The number of CI read requests satisfied from a data space (VGET)
- The number of CIs with updates to a data space (VPUT) This number represents the number of CIs that would have been sent to OTHREAD if the areas were non-VSO.
- The number of CIs read from DASD into a data space (DGET)

Information about data space use is obtained from type X'5937' log records.

Printed Page Line Count Specification (LINECNT)

You can specify the number of lines printed per page for the printed reports. The format of this parameter is:

```
LINECNT=n
```

where n is an integer greater than 5. The value specified applies to titles and headers so that 6 is the minimum allowable value. The default value is 55 lines per page.

Each parameter statement is listed in the SYSPRINT data set exactly as it is read for verification. Figure 116 is an example of parameter statements read from the SYSIN data set and of how they are listed in the SYSPRINT data set. After all parameter statements are read, the utility prints a summary display of either the parameters supplied or the default values that are used for parameters not specified. If you specify both the START and END parameters, then the line `RATE CALCULATION ACTIVE` will be displayed, and the Summary of Region Occupancy Report will be generated. Figure 117 on page 345 is an example of the parameter display. Date information is obtained from the log buffer control record (X'42').

```
SPECIFIED INPUT PARAMETERS:

          ANALYSIS START TIME:  00:00:00     DATE:   89095
                     END TIME:  23:59:59
          A MAXIMUM OF    1000 EXCEPTIONAL TRANSACTIONS WILL BE LISTED.
          RATE CALCULATION ACTIVE: INTERVAL=86399 SECONDS.
          TRANSIT TIME EXCEPTION VALUES:
                                          EXCEPTION VALUE IN SEC.
                    TRANSACTION CODE        (IN-Q THRU OUT-Q)

                    ____________ ____       ________________
                        *GLOBAL*                 0.0
```

Figure 116. Specified Input Parameters

```
LOG DATA SET ANALYSIS FOR IMS FAST PATH
PAGE   1
THE FOLLOWING PARAMETER CARDS WERE READ FROM SYSIN:
LINECNT=45
```

Figure 117. Parameter Display

Error Processing for DFBUTLA0

User abend codes are not generated.

The following return codes are produced:

Code	Meaning
0	Successful completion of analysis
4	Analysis prematurely ended, partial results produced
8	Unable to perform analysis
12	Unable to open ddname SYSPRINT

Related Reading: See *IMS Version 9: Messages and Codes, Volume 1* for an explanation of the messages generated by this utility.

Chapter 15. Offline Dump Formatter Utility (DFSOFMD0)

Use the Offline Dump Formatter utility (DFSOFMD0) to format internal IMS control blocks in a dump that is both independent of a failure and independent of the dumping process. This utility allows you to tailor the dump to print and format only the data areas needed to analyze a particular problem. Use the Offline Dump Formatter utility to:

- Establish the environment needed for offline dump formatting
- Read and check the dump format control statements
- Relocate or load the dump formatting modules
- Direct the offline dump formatting process

The Offline Dump Formatter utility is invoked as a verb exit from the Interactive Problem Control System (IPCS).

Related Reading: See *z/OS MVS Interactive Problem Control System (IPCS) User's Guide* for information about IPCS.

The Offline Dump Formatter utility modules are included in the dumped storage to ensure that the modules used for formatting the dump match the level of the dumped IMS control blocks. These modules can be relocated from the dumped storage, or a fresh copy can be loaded from the program library.

Related Reading: Refer to *IMS Version 9: Diagnosis Guide and Reference* for information about using the Offline Dump Formatter utility to solve problems.

The following topics provide additional information:

Interactive Dump Formatter

IPCS uses menus on the screen to run the Interactive Dump Formatter. These menus allow you to specify the information to be contained in the dump. The Interactive Dump Formatter calls the Offline Dump Formatter utility to perform the required formatting tasks. The output is returned in a format that you can read on the terminal.

Using the Interactive Dump Formatter gives you a menu-driven way to run the Offline Dump Formatter utility without complicated editing of the DFSFRMAT file.

Related Reading:

- See the *IMS Version 9: Diagnosis Guide and Reference* for a full description of the Interactive Dump Formatter and the IPCS menus.
- You can also use the Offline Dump Formatter utility to format various IMS Connect internal control blocks. See the IMS Connect Dump Formatter information in the *IMS Version 9: Installation Volume 2: System Definition and Tailoring*.

Migration Considerations

The Offline Dump Formatter utility can be used even if you have more than one release level of IMS, or if you are using any supported version of IMS. The load modules for the Offline Dump Formatter utility are associated with aliases that allow IMS.SDFSRESL from different releases to be concatenated in IPCS TASKLIB. The aliases are:

Alias	Load Module
DFSOF810	DFSOFMD0
DFSAB810	DFSABND0

The IPCS TASKLIB concatenation can contain multiple execution libraries from IMS Version 4, and one execution library from earlier IMS releases.

Restrictions for DFSOFMD0

The following restrictions apply to the Offline Dump Formatter utility:

- The machine that executes this utility must be licensed to run IMS.
- The Offline Dump Formatter utility is conditionally assembled during IMS control block generation because of dependencies on z/OS services for GETMAIN, ESTAE, and LOAD. If the DFSOFMD0 module is loaded with LOAD SVC by IPCS, the module must be in the STEPLIB data set or in linklist libraries.
- The DFSOFMD0 module must be at the same release level as the IMS system it is formatting. It must be assembled on a z/OS that is the same level as the z/OS it is formatting. This condition applies even if you concatenate an IMS.SDFSRESL from a previous release.
- The version of IPCS you use to execute this utility must be compatible with the z/OS system that was dumped.
- You cannot use the Offline Dump Formatter utility for batch regions that are not currently producing IMS online formatted dumps, such as the Pre-reorganization utility and the Image Copy utility, because they do not contain the required IMS control blocks for IMS dump formatting.
- SYS1.DUMPxx data sets must be large enough to contain a complete dump of the IMS control region, DL/I, DBRC, and IRLM address spaces for systems using the IMS SDUMP option.
- To format Fast Path Dumps, you need to use formatting modules from an IMS system generated with Fast Path.
- If you are using IMS Shared Message Queues or Shared EMH Queues, then your SYS1.DUMPxx data sets must be large enough to contain a dump of the CQS address space in addition to the address spaces. If you are using the Common Service Layer (CSL), then your SYS1.DUMPxx data sets must be large enough to contain a dump of the SCI address space in addition to the address spaces.

Environments for DFSOFMD0

The following sections explain how to use the Offline Dump utility in an IMS online or IMS batch.

IMS Online Environments

To use the Offline Dump Formatter utility in IMS DB/DC, DCCTL, or DBCTL environments, specify the IMS start parameter option FMTO=D.

Related Reading: For more information on the FMTO= parameter see, *IMS Version 9: Installation Volume 2: System Definition and Tailoring*.

You can also use a SYSMDUMP DD statement.

IMS Batch Environments

To format IMS batch job dumps offline in DBCTL, DB/DC, or DCCTL batch environments, you can request a z/OS SYSMDUMP. z/OS creates a dump can be formatted offline using the IMS Offline Dump Formatter utility. Before using the utility, you must remove the SYSUDUMP or SYSABEND DD statement in the IMS batch JCL procedures and insert a SYSMDUMP DD statement.

Related Reading: Refer to the IMSBATCH procedure in *IMS Version 9: Installation Volume 2: System Definition and Tailoring* for more information on IMS batch job dumps.

If the SYSMDUMP data set is too small, unavailable, or unusable, the operating system might be unable to make a usable dump of the batch job.

Input and Output for DFSOFMD0

This utility requires the following input:

- An acceptable machine-readable dump, such as:
  - SDUMP
  - SYSMDUMP
  - Stand-alone dump
  - Dump requested by the z/OS DUMP command
  - Any other machine readable dump of the IMS system address spaces

  The dump must include key 0 and key 7 CSA, the CVT, SQA, and at least one of the CTL or DL/I SAS address spaces. CSA is not required in a batch environment.
- An IMS dump format control data set or FMTIMS (options) specified on the IPCS VERBX control statement.
- Execution of a proper VERBX control statement for IPCS.

The output for this utility is a formatted dump of specified sections of an IMS dump.

If you are using the dump formatter with an execution library that is from an earlier IMS release, a formatter dialog initialization warning occurs if CSA is not included with batch SYSMDUMPs. The dump formatter cannot determine the release levels for the concatenated program libraries, but continues under the presumption that they are correctly concatenated.

IPCS Execution

To use the Offline Dump Formatter utility under IPCS, you must provide an IMS user control statement.

Example: Some examples of the IMS user control statement include:

```
VERBX DFSOFMD0 'jjjjjjjj[,R][,D]' options

VERBX DFSOFMD0 'jjjjjjjj[,R][,H],FMTIMS(ALL)' options

VERBX DFSOF320 'jjjjjjjj,FMTIMS(SCD)' options
```

```
VERBX DFSOF320 'jjjjjjjj[,R][,N],FMTIMS(AUTO,MIN)' options

VERBX IMSDUMP 'jjjjjjjj[,R][,D],FMTIMS(SAVEAREA,DISP)' options

VERBX IMSDUMP 'jjjjjjjj[,R][,D]' options
```

The control statement parameters are:

jjjjjjjj
Indicates the job name or started task name of either the IMS CTL, DL/I, or the IMS batch address space.

R Indicates REFRESH, an optional parameter for requesting that the IMS dump formatter modules be loaded from current program libraries. If you do not specify R, and invalid dumped formatter routines still exist, the invalid routines might be loaded instead of the current libraries.

H Indicates HALFLINE, an optional parameter to request that the IMS dump formatter be limited to the width of a screen (that is, 80 characters per line).

N Indicates NO HEADER, an optional parameter that reduces the header print volume when formatting small data area dumps. The formatter skips the printed header and footer and suppresses the dump content warning messages that describe missing IMS address spaces or address spaces that did not finish initializing.

D Indicates DEBUG, an optional parameter for requesting that the IMS offline formatter not create its ESTAE and thereby allow a dump of any IMS dump formatter abend.

FMTIMS(options)
Specifies the FMTIMS verb. The FMTIMS verb must be specified in either the control statement or in the IMS dump format control data set description (DFSFRMAT DD). FMTIMS permits a subset of formatting options that describe the sections of the IMS dump to be formatted during the current pass of IPCS. The DFSFRMAT DD description describes this subset.

options
Are valid IPCS VERBX command options.

If you do not specify FMTIMS in the user control statement, you must provide an IMS dump format control statement with DFSFRMAT options specified.

Example: The following is an example of a TSO ALLOCATE command to provide IMS dump format control data set information:

```
ALLOC FI(DFSFRMAT) SHR DA('dump.control.dsname')
```

Related Reading: See *MVS/ESA™ Interactive Problem Control System User's Guide and Reference* for more information about IPCS.

DD Statements

INDEX DD
Allows the dump index to print ahead of the formatted dump.

DFSFRMAT DD
Describes an IMS dump format control data set. The data set contains control statements that specify the sections of the IMS dump to be formatted during the current pass of IPCS. If this statement is not specified, the formatting option defaults to SUMMARY.

The IMS dump format control data set is a sequential data set that must be defined with a fixed or fixed-blocked record format (RECFM=F or FB). The record length can be any valid size. The data set contains an FMTIMS verb, followed by subset options describing the sections of IMS to be formatted. You can request a short version of the formatted subset by adding the MIN parameter to the option you select.

You can allow IMS to select the dump formatter options for you by specifying the AUTO option. When you specify AUTO, IMS determines the options to use by looking at the ITASKs that are failing and by selecting the appropriate sets of options for the required dump formatter output. You can specify AUTO with MIN or SUM qualifiers. If you use MIN or SUM, the qualifier is added to each option that AUTO selects.

Subset options can be specified in any combination and in any order. The following subset options can be specified independently or can be qualified as shown, but require no additional arguments:

- ALL or ALL,MIN
- AUTO, or AUTO,MIN, or AUTO,SUM
- CBT
- DB or DB,MIN
- DBRC
- DC or DC,MIN
- DEDB or DEDB,MIN
- DISPATCH or DISPATCH,MIN
- EMH or EMH,MIN
- LOG or LOG,MIN
- LUM
- MSDB or MSDB,MIN
- QM or QM,MIN
- RESTART
- SAVEAREA, or SAVEAREA,MIN or SAVEAREA,SUM
- SB or SB,MIN
- SCD or SCD,MIN
- SPST
- SUBS
- SUMMARY or SUMMARY,MIN
- SYSTEM or SYSTEM,MIN
- UTIL

The following subset options require additional arguments or qualifications as shown:

- CBTE,cbteid
- CLB,address or CLB,nodename or CLB,lterm name or CLB, comm id
- DPST,address or DPST, number or DPST,name
- LLB,link number
- LUB,lu name
- POOL,poolid or POOL,poolid,MIN
- SAP,sapaddr or SAP,ecbaddr

- SYSPST,system pst address or SYSPST,system pst name
- TRACE,name or TRACE,name,MIN

Related Reading: Refer to *IMS Version 9: Diagnosis Guide and Reference* for detailed information about the data areas formatted by these subset options.

Chapter 16. Log Transaction Analysis Utility (DFSILTA0)

Use the Log Transaction Analysis utility (DFSILTA0) to collect information about individual occurrences of IMS transactions, based on records in the IMS log data set. The information collected includes:

- Transaction identification
- Source
- Message processing program (MPP)
- Dependent region
- Priority
- Class of the transaction

Any nonrecoverable and canceled messages are not used.

DFSILTA0 also accumulates:

- The time that each transaction is received
- The time of the message get unique (GU) call
- The time the MPP is terminated
- The time the output message is placed on the output queue
- The time the output message starts to the terminal

From these times, DFSILTA0 calculates:

- Total response time
- Time on the input queue
- Processing time
- Time on the output queue

You can use this information to find bottlenecks in the system and to evaluate whether transaction classes have been assigned correctly. If you are running the Statistical Analysis utility on a smaller portion of the IMS log data, DFSILTA0 can provide a new log tailored to your specifications. DFSILTA0 is put into IMS.SDFSRESL during IMS system definition.

The following topics provide additional information:

- "Restrictions for DFSILTA0" on page 354
- "Input and Output for DFSILTA0" on page 354
- "JCL Requirements for DFSILTA0" on page 354

Related Reading:

- See Chapter 22, "Interpreting Statistical-Analysis and Log-Transaction Reports," on page 491 and "Log Transaction Analysis Utility Reports" on page 496 for information about the Log Transaction Analysis Utility reports.
- You can use KBLA to build JCL and execute DFSILTA0. See "Using KBLA to Run a Job Against IMS Log Records" on page 508 for more information.

Restrictions for DFSILTA0

The Log Transaction Analysis utility has the following restrictions:

- Log data sets from a batch region are not used.
- Any nonrecoverable and canceled messages are not used.
- You must run the Log Merge utility (DFSLTMG0) before you run the Log Transaction Analysis utility against two or more IMS system logs. (The system ID field reflects the order of input to DFSLTMG0.)
- DFSILTA0 creates a queue entry in a GETMAIN storage pool for each transaction that falls within the specified times or checkpoints. These queue entries are not freed nor are they reused until all the log records necessary to complete an entry on the log transaction analysis report are found on the log.
- If a large number of transactions are enqueued but not processed for any reason, an increase in storage usage and processor time can occur.
- Examine control statements for the sort program to determine whether they must be changed, because provision for 256 dependent regions increases the length of the dependent region ID field for the IMS Log-Analysis Report.
- Common Queue Server (CQS) logs cannot be used as input by the Log Transaction Analysis utility because CQS log records have a different format from IMS log records.
- The utility works only with input log data sets created by the same release of IMS as the utility release level.
- Neither BMPs or messages processed by BMPs are processed.

Input and Output for DFSILTA0

There are three types of input to DFSILTA0:

- IMS log data set. This is required.
- Report title statement. This provides descriptive information for the optional title data set.
- Parameters. There are two optional keyword parameters: ST= and OUT=. These specify what portion of the log data set is to be examined for transactions, and what outputs are to be produced. Parameters can be specified in any combination and should be separated by commas.

DFSILTA0 produces the following output:

- A new IMS log data set, if requested
- A detailed report in input sequence (if NOREPORT is not specified)
- A report, on disk, that can be sorted to produce a sequenced report
- A heading report (if NOREPORT is specified)

The starting position and length of the field names on the Detailed Report Format are used in the optional sort step to produce sequenced reports.

JCL Requirements for DFSILTA0

EXEC

Executes the Log Transaction Analysis utility, DFSILTA0.

Example: This example produces a report but no log data set.

```
//STEP0    EXEC PGM=DFSILTA0,PARM='ST=(hhmmss+HHMM,,mm),
//              OUT=NOLOG'
```

ST=

Specifies starting and ending times. If the ST parameter is omitted, the default is the first checkpoint encountered. The format of the ST= parameter is:

```
ST=ALL
   (hhmmss[{+|-}HHMM],
   c,mm,e)
```

Note that the ST= parameter has four positional parameters in addition to the ALL parameter. With the exception of the ALL parameter, these parameters must be enclosed in parenthesis.

ALL
Specifies the complete log data set.

hhmmss
Specifies an hour, minute, and second. Only transactions that originate after the first checkpoint occurring at or after this time are processed. The default is to process 10 minutes from this time.

Note: This parameter is always assumed to refer to a time later than the first checkpoint on the input log. If you want to process transactions starting with the first checkpoint on the log, do not specify a value for this parameter.

{+|-}HHMM
Specifies the time-zone offset used to convert local time to Universal Time Coordinated (UTC) time.

+ or -
Specifies the sign of the offset. Can be blank only if hh and mm are also blank. The time zone is only needed if the offset to the UTC on the day entered is different from the current offset. One example would be if the offset was due to a daylight saving time change.

HH
Specifies hours of offset, a number from 0 to 14 or blank only if mm is also blank

MM
Specifies minutes of offset; can be 00, 15, 30, 45, or blank

If an offset of +|-0000 is specified, the starting time is UTC. If no offset is supplied, the offset is obtained from the z/OS offset.

C Specifies the number of checkpoints to be processed before selection of transactions stops. C is a number from 1 to 9.

MM
Specifies the number of minutes to select transactions. MM is a number between 0 and 99.

E Specifies to end of data set from the specified start time. E is the default.

The Log Transaction Analysis utility scans records between checkpoints. Records before the first checkpoint on an intermediate log data set would only be analyzed by reference to a checkpoint on a previous log.

OUT=
Specifies the desired output. If the OUT= keyword is not specified, the DFSILTA0 defaults produce both a log data set and a report from the log.

NOLOG
Specifies that a new IMS log data set is not to be produced.

NOREPORT
Specifies that no report is to be produced.

DD Statements

STEPLIB DD
Points to IMS.SDFSRESL, which contains the IMS nucleus and required utility modules.

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

HEADING DD
Describes the heading output data set.

```
//HEADING  DD  SYSOUT=A
```

PRINTER DD
Describes the printed report output data set.

```
//PRINTER  DD  SYSOUT=A
```

REPORT DD
Describes the report output data set. This data set can pass to a sort step. Report entry headings and any checkpoint records are not included in this data set.

```
//REPORT  DD  DSN=&&REPORT,DISP=(,PASS),UNIT=SYSDA,
//            SPACE=(CYL,(1,1))
```

LOGIN DD
Describes the input log data set.

```
//LOGIN  DD  DSN=IMS.LOG,DISP=OLD,VOL=SER=XXXXXX,
//           UNIT=YYYY
```

LOGOUT DD
Describes the optional log data set. This log data set can be used as input to the Statistical Analysis utility.

The LOGOUT data set content is identical to that of LOGIN within the interval specified, except that the type 6 record at the beginning of LOGIN is recopied.

```
//LOGOUT  DD  DSN=IMS.LOGOUT,DISP=(,PASS),
//            VOL=SER=XXXXXX,UNIT=TAPE,DCB=(RECFM=VB,
//            LRECL=6004,BLKSIZE=6008)
```

TITLE DD
Describes the optional title data set. This allows for the inclusion of descriptive information on each page of the printer output data set.

```
//TITLE  DD  *
  * * * Descriptive information
```

The SORT step is optional. It is used to produce sequenced reports.

EXEC
Executes the sort program.

```
//STEP1  EXEC  PGM=SORT
```

SYSOUT DD

Describes the message output data set for the sort.

```
//SYSOUT DD SYSOUT=A
```

SORTIN DD

Describes the input data set to the sort. It is the data set described by the REPORT DD statement.

```
//SORTIN  DD  DSN=&&REPORT,DISP=(OLD,DELETE)
```

SORTOUT DD

Describes the output data set to the sort. It is used for printing a sequenced report.

```
//SORTOUT  DD SYSOUT=A
```

SORTWK01-12|DD

Describe the sort program's work data sets. At least three data sets must be used. They can be tape or disk. For disk the format is:

```
//SORTWKnn  DD  UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
```

SYSIN DD

Describes the sort program's control data set. For a control data set in the input stream, the format is:

```
//SYSIN  DD  *
```

Example The following is a sample SORT control statement that provides a report sequenced by message get unique (GU) schedule time within a region:

```
SORT FIELDS=(67,7,CH,A,55,2,CH,A),SIZE=E500
```

Chapter 17. Statistical Analysis Utility (DFSISTS0)

Use the Statistical Analysis utility for analyzing the information on any of the IMS system logs, except those from a batch region. The program modules of this utility reside in IMS.SDFSRESL. The utility consists of modules DFSISTS0, DFSIST20, DFSIST30, and DFSIST40. These modules must be run in sequence.

To run the Statistical Analysis utility on a selected portion of an IMS system log, a new log that is tailored to your own specifications can be created by using the Log Transaction Analysis utility.

Related Reading:

- See Chapter 16, "Log Transaction Analysis Utility (DFSILTA0)," on page 353 for information about the Log Transaction Analysis Utility.
- See Chapter 22, "Interpreting Statistical-Analysis and Log-Transaction Reports," on page 491 and "Log Transaction Analysis Utility Reports" on page 496 for information about the Log Transaction Analysis Utility reports.
- You can use KBLA to build JCL and execute DFSISTS0. See "Using KBLA to Run a Job Against IMS Log Records" on page 508 for more information.

The following topics provide additional information:

- "Restrictions for DFSISTS0"
- "Input and Output for DFSISTS0"
- "Examples of DFSISTS0" on page 365
- "JCL Requirements for DFSISTS0" on page 369
- "Utility Control Statements for DFSISTS0" on page 374

Restrictions for DFSISTS0

The Statistical Analysis utility cannot use Common Queue Server (CQS) logs as input because CQS log records have a different format from IMS log records.

Input and Output for DFSISTS0

The following process occurs when you run the Statistical Analysis utility:

1. The selected log data set is passed to module DFSISTS0 (SORT and EDIT PASS1), which edits and sorts the log data set and outputs a modified log data set.
2. The utility sorts the modified log data set (SORT2).
3. The modified log data set is passed to module DFSIST20 (EDIT PASS2), which edits and outputs a new modified log data set.
4. **Optional:** Either before or after SORT3, the modified log data set can be sent to module DFSIST40 (Message Select and Copy or List), which produces a message list or message data set.
5. The utility sorts the modified log data set (SORT3).
6. The modified log data set is passed to module DFSIST30 (Report Writer), which produces the final statistical reports.

This flow of information is illustrated in Figure 118 on page 360.

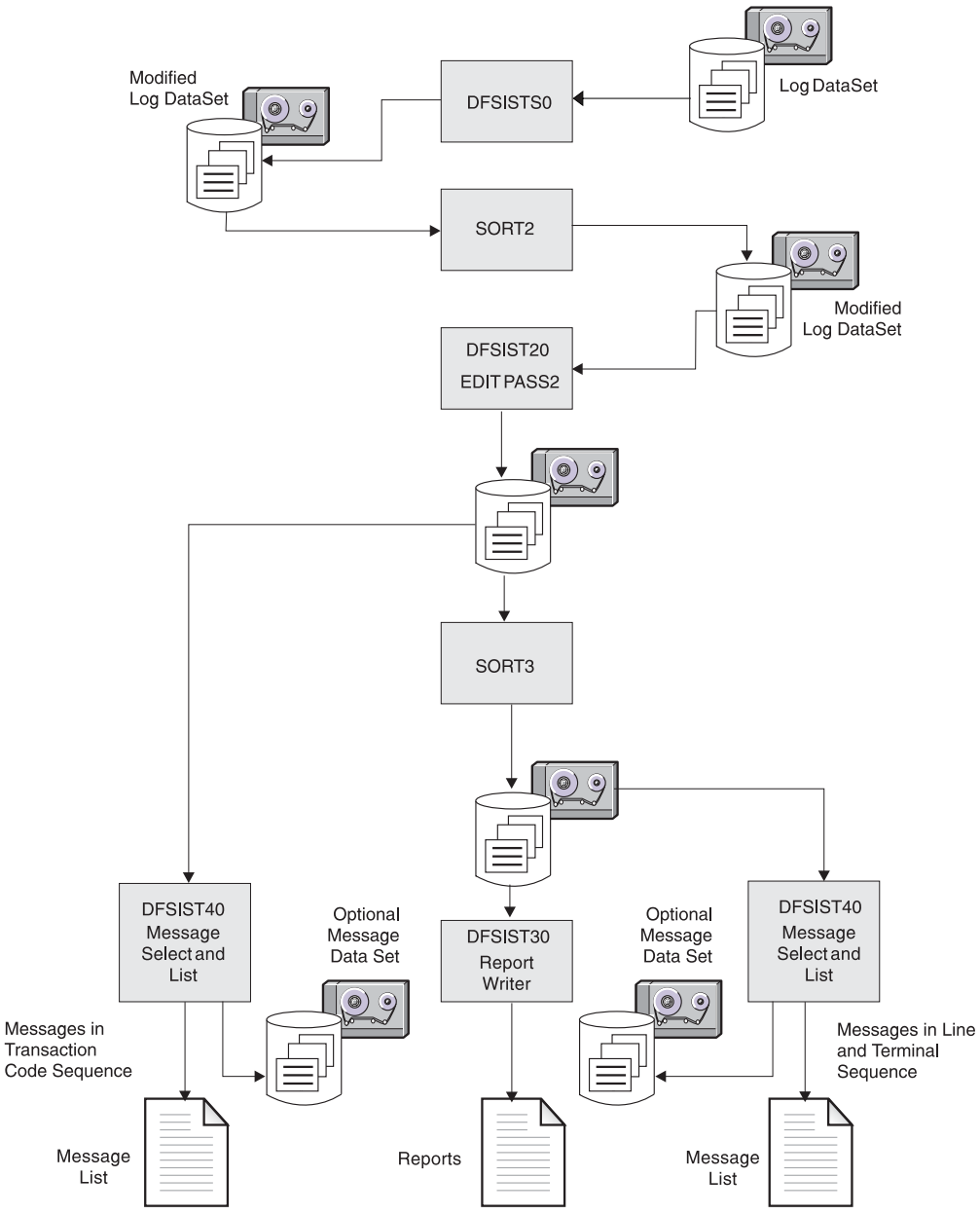


Figure 118. Statistical Analysis Utility Flow of Information

Log Records

The log records used by the IMS Statistical Analysis utility are as follows:

01 Input message ready to be put on the destination message queue

03 Output message segment ready to be put on the destination message queue

06 IMS has been started, a date change has occurred, IMS has been stopped, or a FEOV was issued

07 An application program has been terminated

31 The application program issues a ″get unique″ to retrieve its next message

33 Message queue manager released a record

34 Message canceled and a portion of that message has been previously logged

35 Message has been put on the destination message queue

36 Message has been taken off the destination message queue

The following list provides a detailed explanation of each log record type.

Log Type 01
Log Type 01 record is written when a message is completely received by communications and is ready to be put on the destination queue. The destination queue is either a Scheduler Message Block (SMB) or Communications Name Table (CNT). The SMB destination means a transaction code has been entered by the terminal operator, and an application program will be scheduled. A CNT means a message switch will be done. If the terminal operator entered an LTERM and a message, no application program is necessary. The message will be queued for output directly on the LTERM named in the input message.

Log Type 02
This record is created after a command is successfully completed and before the command completion message is sent. If the command is a /LOG or the command must be reprocessed at restart time, a 02 record is written (for example, /ASSIGN). Type 02 log records are not included in the statistics utilities reports, but can be processed by a user-written routine link-edited with DFSIST00. (The information that can be useful to you are the /LOG records.) These /LOG records are entered by either the remote terminal operator or the master terminal operator.

Log Type 03
When a segment of a message has been created by an application program and is ready to be put on the destination message queue, the 03 record is written. The destination message queue can be either on SMB or CNT. If SMB is the destination, a “program-to-program” message switch is called for by the application program. If the segment is destined for a CNT, the application program is sending an output message to an LTERM.

In a type 03 record, the date and time fields, PDATE and PTIME, are carried forward from the 01 record. When the statistics utilities are run, the 03 records and 36 records are correlated to determine response time. The time reflected is from the time the message is put on the input queue (obtained from the 03 record) until the message is released from the output queue (obtained from the associated 36 record).

Log Type 06
Type 06 records are written when IMS is started (during initialization), when IMS is terminated (immediately prior to closing the log data set), and when a FEOV is issued.

Log Type 07
This record is the application accounting record of the system. The type 07 record is written when an application program terminates in a message processing or batch-message processing region.

Log Type 31
The 31 record is written when the application program issues a ″get unique″ to retrieve its next message.

Log Type 33
The 33 record is written when a message is taken off the input message queue or output message queue.

Log Type 34
A type 34 record is written when a message has been canceled and a portion of that message has already been logged.

Log Type 35
The 35 record is written when a message (input or output) has been put on the destination queue.

If the message is very long and requires ***more than one*** input message buffer, the record has the date and time in it. The date and time in the type 01 record is invalid under this condition.

Log Type 36
A type 36 record is written when a message has been sent in its entirety and the message is ready to be released from the queue. On all devices except display devices, the message is ready to be released from the queue as soon as the last segment is successfully sent to the terminal. Display devices are different. If the display output is only a single page, the message is dequeued after the last segment has been successfully sent.

For multiple pages of display output, the PAGEDEL option selected on the TERMINAL macro at system definition time determines when the message is ready to be released from the queue. If you specify option=PAGEDEL (or PAGEDEL=YES), the message is dequeued when you enter a question mark, PA2 key, or a new input transaction. Option=NPGDEL (or PAGEDEL=NO) ***requires*** you to enter a question mark or PA2 key to take the message off the output queue and write the type 36 record.

The effect of option=NPGDEL (or PAGEDEL=NO) on response time can be dramatic. If you leave the current message displayed for a long period or power off the video device, the message is ***not*** removed from the output queue and the type 36 record is not written until terminal operations begin again. Consequently, response time appears to require many hours or even days.

SORT and EDIT PASS1 (DFSISTS0)

The functions of SORT and EDIT PASS1 are to:

- Select from the system logs those records used by the statistics programs. (Logs from batch regions do not contain the desired records, and cannot be used.)
- Sort message and queue manager log records so that all segments of a multi-segment message appear together, and enqueue and dequeue records associated with the messages to which they refer.
- Edit the records so that the input message, and all output sent as a result of that input, are contiguous after sorting. Any nonrecoverable and canceled messages are not used.

Concatenation of logs from multiple systems is permitted.

Restrictions:

- The JCL for SORT and EDIT PASS1 must contain a JOBLIB or STEPLIB statement for the library containing the utility program (IMS.SDFSRESL).
- The ',NOTXT' parameter causes the program to ignore the text of the X'01' (input message) and X'03' (output message) log records, thereby reducing the volume

of all sort passes. If you use this parameter, the Message Select and Copy or List utility (DFSIST40) cannot be run. The DFSISDBX suffix is no longer used and will be ignored if you specify it.

EDIT PASS2 (DFSIST20)

The function of EDIT PASS2 is to take the records to be used to produce the statistical reports from system messages. If DFSIST40 (Message Select and Copy or List utility) is not run as part of the statistics job stream, approximately 40% of the output of DFSIST20 can be eliminated by coding NOTXT on DFSISTS0 or NOLOG in the SLDS control statement of the Log Archive utility.

Report Writer (DFSIST30)

The function of DFSIST30 is to produce the final statistical reports.

The different types of statistical reports are described as follows:

- Messages Queued but Not Sent—by destination

  The output message (X'03') appears on the log, but no record (X'36') appears to indicate that the message was sent to the terminal. Output is sorted by symbolic terminal name.
- Messages—Program to Program—by destination

  An output message (X'03') is sent to an SMB. Output is sorted by destination.
- Line-and-Terminal Report

  Line-and-terminal report shows the line and terminal loading by time of day (can be used to determine the line and terminal utilization, peak traffic periods, and so forth).

  Counts input messages (R), X'01', to IMS from each LTERM, and output messages (S), X'03', to each LTERM from IMS. The report is arranged in line number (relative terminal sequence). A message switch counts as two messages; one from the originating terminal, one to the destination terminal. A broadcast message counts as one message from the originating terminal, and one message each to the destination terminals.

  The next four reports deal with transaction codes. If an output message is generated by a command from a different terminal, the input prefix data is replaced by the message “THIS OUTPUT NOT RESULT OF INPUT.” An X'03' message generated by the system, independent of terminal input, has a transaction code of IMSSYS. If an output message was generated by an input message that was not on the log or by a command from the same terminal (for example, DISPLAY), the transaction code is NOTAVA; otherwise, the transaction code can be found in the generating X'01' log record.
- Messages Queued but Not Sent—by transaction code

  The output message (X'03') appears on the log, but no record (X'36') appears to indicate that the message was sent to the terminal. Output is sorted by transaction code.
- Messages—Program to Program—by transaction code

  An output message (X'03') was sent to an SMB. Output is sorted by transaction code.
- Transaction Report

  This report shows loading by transaction code and by time of day. The time for input messages to IMS from each logical terminal is indicated by “R”; the time for

output messages to each logical terminal from IMS is indicated by “S”. The report counts the same messages as the Line-and-Terminal Report. Input is sorted by transaction code.

The transaction code column can contain the following entries:

(NOSORC) The output message was generated by a command.

(NOTAVA) The output message was generated by an input message that was not on the input log.

(IMSSYS) The output message was generated by IMS.

- Transaction-Response Report

  Measures two response times. The first line is response time from complete receipt of the input message (enqueue time X'35') until the response message to the terminal is successfully dequeued (X'36'). The second line is response time from complete receipt of the input message (enqueue time X'35') until the response message to the terminal is started (GU time X'31').

  There can be multiple responses from a single transaction, and they can include any output messages from program-to-program switch transactions that are a result of the original input message.

  The percentile report shows shortest response, longest response, and 25th, 50th, 75th, and 95th percentile response. A response time within the *n*th percentile is greater than or equal to n% of the total number of response times processed for that transaction code. For example, a 04.3S number under the '75% RESPONSE' column means that 75% of the total responses for that transaction were equal to or less than 04.3 seconds.

- Application-Accounting Report

  Provides sufficient data to allow machine charges to be distributed among application programs or transaction codes.

  The following information is contained in this report:

  – Counts of all requests to DL/I

  – Amount of processor task time

  All requests for services from DL/I, for access to messages or databases, are counted. These counts are accumulated by program, by transaction code within program, and by priority within transaction code.

  Counts of messages processed, and of “get uniques,” are included. The count will be different because of “get unique” issued on which end-of-file is returned.

  Task time is set when a request for scheduling is made. The value is the maximum time for each transaction, multiplied by the maximum number of transactions. The remaining time is requested prior to the next request for scheduling. This time is the actual time the program executed. It does not include any wait time for accessing data. This time can be incorrect if the application program is a BMP and issues a TTIMER or STIMER macro.

  Average Processor Time is the total message processor time, divided by the number of messages. It is not rounded. The final average processor time is a recalculated average.

  Number of Bad Completion Codes reflects the number of times an application program terminates abnormally, or returns with other than zero in register 15.

- IMS-Accounting Report

  Shows start and stop times for the IMS control region.

- Operating Information

  – Reports produced, either with or without date control.

- Program determines if input was sorted on date.
- Control break occurs whenever date changes, totals printed, and new report started.
- If not sorted on date, process all the log data sets at one time for a period (such as one week) to produce one summary report.
- The LINECNT=XX parameter can be included on the EXEC statement for the REPORT WRITER (DFSIST30). This is the only parameter expected, and it is optional. If it is not included, the default line count is 36.
- Printing of the different statistical reports is not optional; they are all generated.

Message Select and Copy or List (DFSIST40)

The execution of the Message Select and Copy or List program is optional. You can execute it as a separate step in the same job with the statistical reports, or run it independent of the statistical reports.

This program takes output from the second edit program, DFSIST20, before it is sorted (in line-and-terminal sequence), or after sorting (in transaction-code sequence). Input to this program is specified on the IMSLOGI DD statement, described in “DD Statements” on page 371. To have messages printed in the sequence they occurred (that is, each input message associated with its output message), the input to this program must be &&ED34IN.

Examples of DFSISTS0

This section contains examples of the output produced by the Report Writer (DFSIST30) and the Message Select and Copy or List (DFSIST40) programs.

Report Writer (DFSIST30) Output

Following is a list of statistics reports produced by the Report Writer (DFSIST30). Examples of the reports follow. (The report date, which is in the upper right corner of these examples, will not appear unless a sort by date is specified.) The reports produced are:

- Messages—Queued but Not Sent by Destination (Figure 119 on page 366)
- Messages—Program to Program by Destination (Figure 120 on page 366)
- Line and Terminal (Figure 121 on page 366)
- Messages—Queued but Not Sent by Transaction Code (Figure 122 on page 367)
- Messages—Program to Program by Transaction Code (Figure 123 on page 367)
- Transaction (Figure 124 on page 367)
- Transaction Response (Figure 125 on page 367)
- Application Accounting (Figure 126 on page 368)

Examples

```
       M E S S A G E S -- Q U E U E D  B U T  N O T  S E N T       D A T E  04/17/93                    P A G E    1
                TOTAL
 DESTINATION    MESSAGES

 CTRL                 1
 PDSW0032             1
 PDSW0043             1
 PDSW0053             1
 PDSW0064             1
 PDSW0082             1
```

Figure 119. Messages—Queued but Not Sent (by Destination)

```
       M E S S A G E S -- P R O G R A M  T O  P R O G R A M         D A T E  04/17/93                    P A G E    1
                TOTAL
 DESTINATION    MESSAGES

 DE2Q               645
 DE2R               735
 DE2S               784
 DE2T               757
```

Figure 120. Messages - Program to Program (by Destination)

```
            L I N E   A N D   T E R M I N A L   R E P O R T           D A T E  04/17/93                    P A G E    1
LINE RTN       TOTAL        TOTAL         AVG                  HOURLY       DISTRIBUTION
 OR NODE R/S   MESSAGES    CHARACTERS     SIZE  00-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-24

DSWP0011
PDSW0011 S          13         2,098       161     0     0     0     0     0     0     0     0     0    13     0     0     0     0
         R           7         1,067       152     0     0     0     0     0     0     0     0     0     7     0     0     0     0
DSWP0012
PDSW0012 S          11           352        32     0     0     0     0     0     0     0     0     0    11     0     0     0     0
         R           3           190        63     0     0     0     0     0     0     0     0     0     3     0     0     0     0
DSWP0013
PDSW0013 S          14         1,775       126     0     0     0     0     0     0     0     0     0    14     0     0     0     0
         R           7         1,012       144     0     0     0     0     0     0     0     0     0     7     0     0     0     0
DSWP0014
PDSW0014 S          15         1,151        76     0     0     0     0     0     0     0     0     0    15     0     0     0     0
         R           5           825       165     0     0     0     0     0     0     0     0     0     5     0     0     0     0
DSWP0015
PDSW0015 S          12           678        56     0     0     0     0     0     0     0     0     0    12     0     0     0     0
         R           5           491        98     0     0     0     0     0     0     0     0     0     5     0     0     0     0
DSWP0016
PDSW0016 S          11           355        32     0     0     0     0     0     0     0     0     0    11     0     0     0     0
         R           4           298        74     0     0     0     0     0     0     0     0     0     4     0     0     0     0
DSWP0017
PDSW0017 S          10           351        35     0     0     0     0     0     0     0     0     0    10     0     0     0     0
         R           3           190        63     0     0     0     0     0     0     0     0     0     3     0     0     0     0
         R           7           949       135     0     0     0     0     0     0     0     0     0     7     0     0     0     0
PMTO1AP
CTRL     S          16           930        58     0     0     0     0     0     0     0     0     0    16     0     0     0     0
 SYSTEM  S      53,695     5,428,432       101     0     0     0     0     0     0     0     0     0 53695     0     0     0     0
 TOTALS  R      23,934     3,367,375       140     0     0     0     0     0     0     0     0     0 23934     0     0     0     0
```

Notes:

1. LINE RTN = Line Relative Terminal Number
2. R/S = Received/Sent

Figure 121. Line-and-Terminal Report

```
       M E S S A G E S --  Q U E U E D   B U T   N O T   S E N T       D A T E  04/17/93                      P A G E    1
TRANSACTION        TOTAL
    CODE         MESSAGES

 (IMSSYS)              31
 DE1Q                  39
 DE1R                  54
 DE1S                  57
 DE1T                  71
 HR2Q                   1
 IT8T                   1
 OE1Q                   1
 OE2Q                  21
 OE2R                  15
 OE2S                  26
 OE2T                  14
 OE4S                   1
 SC2R                   1
```

Figure 122. Messages—Queued but Not Sent (by Transaction Code)

```
       M E S S A G E S --  P R O G R A M   T O   P R O G R A M       D A T E  04/17/93                      P A G E    1
TRANSACTION        TOTAL
    CODE         MESSAGES

 (NOTAVA)              1
 DE1Q                645
 DE1R                735
 DE1S                784
 DE1T                756
```

Figure 123. Messages - Program to Program (by Transaction Code)

```
                  T R A N S A C T I O N   R E P O R T                    D A T E  04/17/93                                                  P A G E    4
TRANSACTION      TOTAL         TOTAL          AVG                          HOURLY       DISTRIBUTION
   CODE  R/S   MESSAGES     CHARACTERS       SIZE  00-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-24

SC6T     S          947        208,340        220     0     0     0     0     0     0     0     0     0   947     0     0     0     0
         R          947         53,032         56     0     0     0     0     0     0     0     0     0   947     0     0     0     0
TS1Q     S          330         13,200         40     0     0     0     0     0     0     0     0     0   330     0     0     0     0
         R          330         18,150         55     0     0     0     0     0     0     0     0     0   330     0     0     0     0
TS1R     S          373         14,920         40     0     0     0     0     0     0     0     0     0   373     0     0     0     0
         R          373         20,515         55     0     0     0     0     0     0     0     0     0   373     0     0     0     0
TS1S     S          388         15,520         40     0     0     0     0     0     0     0     0     0   388     0     0     0     0
         R          388         21,340         55     0     0     0     0     0     0     0     0     0   388     0     0     0     0
TS1T     S          340         13,600         40     0     0     0     0     0     0     0     0     0   340     0     0     0     0
         R          340         18,700         55     0     0     0     0     0     0     0     0     0   340     0     0     0     0
 SYSTEM  S       53,695      5,428,432        101     0     0     0     0     0     0     0     0     0 53695     0     0     0     0
 TOTALS  R       23,934      3,367,375        140     0     0     0     0     0     0     0     0     0 23934     0     0     0     0
```

Figure 124. Transaction Report

```
          T R A N S A C T I O N   R E S P O N S E   R E P O R T          D A T E  04/17/93                      P A G E    4
TRANSACTION      TOTAL          LONGEST          95%             75%             50%             25%          SHORTEST
   CODE        RESPONSES       RESPONSE       RESPONSE        RESPONSE        RESPONSE        RESPONSE       RESPONSE

                  947          03.0S          01.9S           00.2S           00.1S           00.1S          00.0S
  TS1Q              330            03.3S          00.6S           00.2S           00.1S           00.1S          00.0S
                  330          03.1S          00.5S           00.1S           00.0S           00.0S          00.0S
  TS1R              373            01.3S          00.5S           00.1S           00.1S           00.1S          00.0S
                  373          01.3S          00.4S           00.1S           00.0S           00.0S          00.0S
  TS1S              388            03.3S          00.7S           00.2S           00.1S           00.1S          00.0S
                  388          03.0S          00.5S           00.1S           00.0S           00.0S          00.0S
  TS1T              340            03.8S          00.6S           00.2S           00.1S           00.1S          00.0S
                  340          03.0S          00.5S           00.1S           00.0S           00.0S          00.0S
TOTAL RESPONSES =               26525
```

Figure 125. Transaction-Response Report

Examples

```
       A P P L I C A T I O N   A C C O U N T I N G   R E P O R T        D A T E  04/17/93                        P A G E     4
PROGRAM TRANSACTION   MESSAGE- - - - COUNTS    DATA - - - - - - - - - - BASE - - - - - - - - - COUNTS  CC OR RC     TOT PROG      AVR
 NAME      CODE    PRI QTY    GU    GN  ISRT*   GU    GN   GNP   GHU   GHN  GHNP  ISRT  DLET  REPL   NOT 0       CPU TIME      TIME

PROGTS1R TS1R     01  373   717     0   373     0     0     0     0     0     0     0     0     0     0            01.1S      0.003S
PROGTS1S TS1S     01  388   748     0   388     0     0     0     0     0     0     0     0     0     0            01.1S      0.003S
PROGTS1T TS1T     01  340   657     0   340     0     0     0     0     0     0     0     0     0     0            01.0S      0.003S
SYSTEM TOTALS         349*  580*  107*  704* 1025*  328* 1520*  247*    0   249*  348* 3664   460*    0        06M 55.5S      0.011S
* INDICATES TOTAL SHOWN IN 100'S
@ INDICATES TOTAL SHOWN IN 10,000'S
             I M S   ACCOUNTING   REPORT                              D A T E  04/17/93                         P A G E     1


         START TIME 15:50:50
         I M S  DAY             04/17/93**
          STOP TIME 15:56:16
REPORT PERIOD IS FROM 04/17/93 TO 04/17/93.
END OF REPORTS
```

***** Second insert is counted for single user issued insert if all the following conditions are met:

1. New HIDAM or PHIDAM Root
2. Not Duplicate Key (II status not returned)

****** These dates will not appear unless the input to DFSIST30 is sorted with date control.

Figure 126. Application-Accounting Report

Message Select and Copy or List (DFSIST40) Output

Figure 127 on page 369 shows an example of the report produced by the Message Select and Copy or List program.

```
           MESSAGES

INPUT    TRANSACTION  LINE   RELA  SEQ  SYMBOLIC               OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX        CODE     NO    TERM  NO   ADDRESS   DATE    TIME  PREFIX  NAME      NO     ADDRESS    DATE    TIME
       THIS OUTPUT NOT RESULT OF INPUT                                  DSWP5008  00017  PDSW5008   93.107  15.54.1
                        3
OUTPUT  SEG=001 LEN=0001*F*
INPUT    TRANSACTION  LINE  RELA   SEQ  SYMBOLIC               OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX        CODE     NO   TERM   NO   ADDRESS   DATE    TIME  PREFIX  NAME      NO     ADDRESS    DATE    TIME
       THIS OUTPUT NOT RESULT OF INPUT                                  DSWP5008  00019  PDSW5008   93.107  15.54.4
OUTPUT SEG=001 LEN=0009*88-3-2000*
                                        3              3                3                          3
OUTPUT SEG=002 LEN=0248*WITHDRAWAL   $300.00 FDEPOSIT   $6704.62 FSAVINGS   444.44 FCHECKING    $9800.50 F*
                                        3              3                3                          3
                      *OVERDRAFT     $30.32FVISA       $2020.20 FMASTER CHRGE $105.00 FCARLOAN $1040.00 F*
                                       3
                      *TRANSFER C-5  $50.00 FCHRISTMAS CLUB  $94.60*
INPUT    TRANSACTION    NODE       SEQ  SYMBOLIC                  OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX      CODE        NAME       NO   ADDRESS   DATE       TIME  PREFIX  NAME      NO     ADDRESS     DATE    TIME
          DE1Q          DSWPOO56  00015 PDSW0056  93.107   15.53.51        DSWP0056  00016  PDSW0056   93.107  15.54.2
                          03     0  18D
INPUT  SEG=001 LEN=0016*1BDE1Q  3Y43A*
INPUT  SEG=002 LEN=0230* 23(9) WITHDRAW OF $300DEPOSIT OF $6704.62SAVINGS DEPOSIT OF $444.44CHECKING TRANSFER OF $9800.50OV*
                      *ERDRAFT OF $30.32VISA ENTRY OF $2020.20MASTER CHARGE OF $105.00CAR LOAN OF $140.00TRANSFER C-S OF $*[1]
                      *50.00CHRISTMAS CLUB OF $94.60Y
INPUT    TRANSACTION    NODE       SEQ  SYMBOLIC
PREFIX      CODE        NAME       NO   ADDRESS   DATE       TIME
          DE1Q          DSWP0084  00017 PDSW5008  93.107   15.54.25
                                                    3
OUTPUT SEG=001 LEN=0031*+ DATA SUCCESSFULLY RECEIVED +F*
INPUT    TRANSACTION  LINE   RELA  SEQ  SYMBOLIC               OUTPUT   NODE      SEQ    SYMBOLIC
PREFIX      CODE       NO    TERM  NO   ADDRESS   DATE       TIME  PREFIX   NAME      NO     ADDRESS     DATE    TIME
          DE1Q[2]      DSWP016    00018 PDSW0116  93.107   15.54.36         DSWP0116  00016  PDSW0116   93.107  15.54.36
```

Notes:

1. Indicates a 230-character report message
2. Indicates a 31-character message generated by the transaction code ″DE1Q″ and transmitted to a relative terminal DSWP0116.

Figure 127. Messages Report

JCL Requirements for DFSISTS0

The JCL for execution of the IMS Statistical Analysis utility is given in Figure 128 on page 370. Also see the appropriate operating system Sort/Merge program manual.

```
//STATS    JOB 1,NAME,MSGCLASS=A,MSGLEVEL=1,PRTY=8
//JOBLIB    DD DSNAME=IMS.SDFSRESL,DISP=SHR
//*
//ST1     EXEC PGM=DFSISTS0
//SORTLIB   DD DSN=SYS1.SORTLIB,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUDUMP  DD SYSOUT=A
//SYSOUT    DD SYSOUT=A
//LOGIN     DD DSN=IMSLOG,DISP=OLD,
//             UNIT=TAPE,VOL=SER=LOGTAP
//SORTWK01  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK02  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK03  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTOUT   DD DUMMY,DCB=*.LOGIN
//LOGOUT    DD DSN=&&EDIT1,DISP=(NEW,PASS),
//             UNIT=SYSDA,
//             DCB=(RECFM=VB,BLKSIZE=3996,LRECL=3992,BUFNO=3),
//             SPACE=(CYL,(5,5))
/*
//ST2     EXEC PGM=SORT,REGION=256K
//SORTLIB   DD DSN=SYS1.SORTLIB,DISP=SHR
//SYSOUT    DD SYSOUT=A
//SORTIN    DD DSN=&&EDIT1,DISP=(OLD,DELETE)
//SORTWK01  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK02  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK03  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTOUT   DD DSN=&&EDIT1S,DISP=(NEW,PASS),
//             UNIT=SYSDA,
//             DCB=*.SORTIN,
//             SPACE=(CYL,(5,5))
//SYSIN     DD *
 SORT    FIELDS=(5,1,CH,A,9,4,PD,A,13,38,CH,A),SIZE=E200
/*
//*
//ST3     EXEC PGM=DFSIST20
//EDITDCB1  DD DSN=&&EDIT1S,DISP=(OLD,DELETE)
//EDITDCB2  DD DSN=&&EDIT2,DISP=(NEW,PASS),
//             UNIT=SYSDA,
//             DCB=(RECFM=VB,BLKSIZE=4016,LRECL=4012,BUFNO=3),
//             SPACE=(CYL,(5,5))
//SYSPRINT  DD SYSOUT=A
/*
//ST4     EXEC PGM=SORT,REGION=256K
//SORTLIB   DD DSN=SYS1.SORTLIB,DISP=SHR
//SYSOUT    DD SYSOUT=A
//SORTIN    DD DSN=&&EDIT2,DISP=(OLD,DELETE)
//SORTWK01  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK02  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTWK03  DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
//SORTOUT   DD DSN=&&ED34IN,DISP=(NEW,PASS),
//             UNIT=SYSDA,
//             DCB=*.SORTIN,
//             SPACE=(CYL,(1,1))
//SYSIN     DD *
 SORT    FIELDS=(5,1,CH,A,9,4,PD,A,13,40,CH,A),SIZE=E200
/*
//ST5     EXEC PGM=DFSIST30
//EDITDCB2  DD DSN=&&ED34IN,DISP=(OLD,PASS)
//PRINTDCB  DD SYSOUT=A,DCB=(BLKSIZE=133,LRECL=133,RECFM=FA)
//SYSPRINT  DD SYSOUT=A
```

Figure 128. JCL for the Statistical Analysis Utility (Part 1 of 2)

```
/*
//ST6     EXEC PGM=DFSIST40
//IMSLOGP   DD SYSOUT=A,DCB=(BLKSIZE=133,LRECL=133,RECFM=FA)
//IMSLOGI   DD DSN=&&ED34IN,DISP=(OLD,DELETE)
//SYSPRINT  DD SYSOUT=A
//SYSIN     DD *
TRANS CODE=(ALL,I,O)
NON PRINT=HEX
/*
//
```

Figure 128. JCL for the Statistical Analysis Utility (Part 2 of 2)

The LRECL and BLKSIZE for the log can be calculated as follows:

LRECL
(Larger of 1032 or RECLNG parameter of the MSGQUEUE macro for IMS.LGMSG) + 16

BLKSIZE
Larger of LRECL + 4 or BLKSIZE parameter on the IEFRDERDD statement in the IMS cataloged procedure

// EXEC
Does one of the following:

- Invokes the initial selection and sort process in the statistics program jobstream. If DFSIST40 is not run, 'NOTXT' improves performance. Its format is:

  ```
  //ST1 EXEC PGM=DFSISTS0[PARM=',NOTXT']
  ```

- Executes the sort program. You can improve efficiency by providing as much main storage as possible. Sort computer storage size needed based on number of work data sets allocated. Its format is:

  ```
  //ST2 EXEC PGM=SORT,REGION=256K
  ```

- Invokes the second statistics edit module, DFSIST20. If DFSIST40 (Message Select and Edit) is not being run, specify NOTXT on DFSISTS0. Its format is:

  ```
  //ST3 EXEC PGM=DFSIST20
  ```

- Invokes DFSIST30 (Report Writer). Its format is:

  ```
  //ST5 EXEC PGM=DFSIST30[,PARM='LINECNT=XX']
  ```

  If LINECNT is not specified, the default is 36.

- Invokes Message Select and Edit (DFSIST40). This step is optional, and a number of DFSIST0 options apply. This format of the statement is:

  ```
  //ST6 EXEC PGM=DFSIST40[,PARM='LINECNT=XX']
  ```

  If LINECNT is not specified, the default is 36.

DD Statements

//JOBLIB DD
Describes the program library containing the utility programs. Its format is:

```
//JOBLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

//LOGIN DD
Describes the input log data set. Multiple volumes and data sets can be concatenated within one statistics program run. Its format is:

```
//LOGIN DD DSNAME=IMSLOG,DISP=OLD,VOL=SER=XXXXXX,UNIT=TAPE
```

where XXXXXX is the volume serial number of the log data set being processed. (For this example, LRECL=3964 and BLKSIZE=3968.)

//SORTWK01-32 DD

Describes the sort program's work data sets. The space defined can vary. The number of data sets must be at least three. They can be on either tape or disk. For a disk sort, the format is:

```
//SORTWKnn DD UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
```

//SORTLIB DD

Describes the library containing the sort program's modules. Its format is:

```
//SORTLIB DD DSNAME=SYS1.SORTLIB,DISP=SHR
```

//SORTOUT DD

Does one of the following:

- Does not use the output data set. However, the DCB information must appear on the DD statement. Its format is:

  ```
  //SORTOUT DD DUMMY,DCB=*.LOGIN
  ```

- Describes the output data set to the sort. Its format is:

  ```
  //SORTOUT DD DSNAME=&&EDIT1S,DISP=(NEW,PASS),
  // UNIT=SYSDA,SPACE=(CYL,(5,5)),DCB=*.SORTIN
  ```

  BLKSIZE and LRECL are the same as for //EDITDCB1 DD.

- Describes the output of the sort that serves as input to DFSIST30 or DFSIST40. Its format is:

  ```
  //SORTOUT DD DSNAME=&&ED34IN,UNIT=SYSDA,;
              DISP=(NEW,PASS),SPACE=(CYL,(1,1)),
              DCB=*.SORTIN
  ```

  The normal sort control statement is shown as follows.

  ```
  SORT FIELDS=(5,1,CH,A,13,40,CH,A),SIZE=XXXX
  ```

  To sort on date and produce reports under date control, the statement is as follows:

  ```
  SORT FIELDS=(5,1,CH,A,9,4,PD,A,13,38,CH,A),SIZE=XXXX
  ```

//LOGOUT DD

Describes the output of DFSISTS0. This data set is normally a temporary one. It serves as input to the next step (a sort). To break the statistics program into multiple jobs, you must modify this statement. Its normal format is:

```
//LOGOUT DD DSN=&&EDIT1,DISP=(NEW,PASS),
//          UNIT=SYSDA,SPACE=(CYL,(5,5)),DCB=(RECFM=VB,
//          BLKSIZE=3996,LRECL=3992,BUFNO=3)
```

BLKSIZE and LRECL can be changed here and in subsequent steps. LRECL must be at least as large as LRECL for //LOGIN DD, plus 28 bytes for additional prefix information. Space is a function of the input volume.

//SYSPRINT DD

Describes the output data set for control messages. Its format is:

```
//SYSPRINT DD SYSOUT=A
```

The next step is a sort, and all DD statements, with the exception of SORTIN and SORTOUT, are the same as the previous sort.

//SYSOUT DD

Describes the message output data set. Its format is:

```
//SYSOUT DD SYSOUT=A
```

//SORTIN DD

Does one of the following:

- Describes the input data set to the sort. It is the data set described by the DD statement LOGOUT in the previous step. Its format is:

  ```
  //SORTIN DD DSNAME=&&EDIT1,DISP=(OLD,DELETE)
  ```

- Refers to the output of DFSIST20. Its format is:

  ```
  //SORTIN DD DSNAME=&&EDIT2,DISP=(OLD,DELETE)
  ```

//SYSIN DD

Does one of the following:

- Describes the sort's control data set normally in the input stream. It is normally a DD * statement (followed by the sort control statement.)

  Sample sort control statement:

  ```
  SORT FIELDS=(5,1,CH,A,9,4,PD,A,13,36,CH,A),SIZE=XXXX
  ```

- Describes the control data set for DFSIST40. It is normally a DD * statement. See "Transaction Code Control Statement" on page 374 for the control statement format.

//EDITDCB1 DD

Describes the input data set to DFSIST20 (output of sort in previous step). Its format is:

```
//EDITDCB1 DD DSNAME=&&EDIT1S,DISP=(OLD,DELETE)
```

//EDITDCB2 DD

Does one of the following:

- Describes the output of DFSIST20. Its format is:

  ```
  //EDITDCB2 DD DSNAME=&&EDIT2,DISP=(NEW,PASS),
  //            UNIT=SYSDA,SPACE=(CYL,(5,5)),
  //            DCB=(RECFM=VB,BLKSIZE=4016,LRECL=4012,
  //            BUFNO=3)
  ```

  Requirement: LRECL must be 20 bytes larger than SORTOUT in the previous step. BLKSIZE must be increased proportionately.

- Describes the input to the report writer (the output of the previous sort). Its format is:

  ```
  //EDITDCB2 DD DSNAME=&&ED34IN,DISP=(OLD,PASS)
  ```

//PRINTDCB DD

Describes the output of the report writer, normally the output stream. It can be blocked or unblocked, because I/O is performed using QSAM, with QSAM acquiring the buffers. Its format is:

```
//PRINTDCB DD SYSOUT=A,DCB=(BLKSIZE=133,
//            LRECL=133,RECFM=FA)
```

//IMSLOGI DD

Describes the input to Message Select and Copy or List (DFSIST40). This program uses the same data set for input as DFSIST30 (that is, output of the second sort) or the output of Edit Pass 2 directly. The format of this statement (assuming use of sorted input) is:

```
//IMSLOGI DD DSNAME=&&ED34IN,DISP=(OLD,DELETE)
```

//IMSLOGP DD

Describes the program's output. The format of the statement is the same as the PRINTDCB statement for DFSIST30.

//IMSLOGO DD

Is optional. It can be used to create a data set composed of your messages. Its format is:

```
// IMSLOGO DD DSNAME=OUTPUT,UNIT=tttt,
//            DISP=(NEW,KEEP),DCB=(RECFM=VB,
//            LRECL=4012,BLKSIZE=4016)
```

Figure 128 on page 370 is an example of the JCL for the Statistical Analysis utility. This is a full statistics, job-stream example with sorting by date that produces reports under date control. BLKSIZE and LRECL in all data sets are dependent on the input log.

Utility Control Statements for DFSISTS0

Message Select and Copy or List selects messages based on control statements read from SYSIN. Messages selected are printed or copied onto an output data set. If the DD statement IMSLOGO is included, an output data set is created. If the DD statement IMSLOGP is included, messages selected are printed. Both DD statements can be included in a single run.

The following restrictions apply to the control statements:

- All control statements begin in position 1, with a keyword identifying that control statement.
- Following the keyword is a series of parameters, enclosed within parentheses and separated by commas.
- Control statements cannot be continued beyond position 71.
- Multiple control statements with the same keyword, starting in position 1, are permitted.
- Within parentheses, all parameters are positional; missing parameters must be indicated by commas.
- Messages are selected if they fulfill at least one of the criteria specified by the control statement.

A group of names can be indicated by terminating the parameter with an *.

Example: INV* causes the names INV, INVENTORY, INVA, and INVB to be selected.

The name parameter ALL can be used to select all names rather than a specified name.

Transaction Code Control Statement

The format of the transaction code control statement is:

```
TRANS CODE=(TRANSCOD,I,O),(TRANSA,I),(INV*,,O),(ALL,I,O)
```

- The first parameter is a transaction code of from 1 to 8 characters.
- The second parameter, I, selects input messages with this code.
- The third parameter, O, selects output messages resulting from this code.
- A transaction code of ALL selects transaction codes.
- An asterisk within the transaction code causes only characters preceding the asterisk to be compared with the corresponding number of characters from the input transaction code to determine selection. You can use this to select groups of transaction codes.

Symbolic Terminal Name Control Statement

Examples of the symbolic terminal name control statement are:

```
SYM NAME=(TERMA,I,O),(TERM*,I),(TERMINV,,O,ALL)
SYM NAME=(TERMPAY,I,O,TERMA)
SYM NAME=(ALL,,O,TERMA)
```

- The first parameter is a symbolic terminal name of from 1 to 8 characters.
- The second parameter, I, selects input from this terminal.
- The third parameter, O, selects output generated by input from this terminal.
- You can further qualify the output parameter, O, with another symbolic terminal name. If you do this, only output to that symbolic name which resulted from inputs from the preceding name will be selected. If you specify ALL, all output from the terminal represented by the preceding name is selected.

Hardware Terminal Address Control Statement

The format of the hardware terminal address control statement is:

```
TERM ADDR=(3,1,I,O),(42,3,,O,21,A),(1,ALL,I,O)
```

- Selection by hardware terminal name is similar to selection by terminal symbolic name, except that, instead of symbolic name, the line number and relative terminal number are specified.
- The first parameter is the line number or ALL.
- The second parameter is the relative terminal number on the line or ALL.
- The third and fourth parameters are I and O for selection of input to and output from this terminal.
- Output can be further qualified (similar to symbolic terminal output).
- If an output message is queued but not sent, it is not selected, even if ALL is specified. The SYM NAME control statement must be used.

VTAM Terminal Name Control Statement

The format of the VTAM terminal name control statement is:

```
VTERM NAME=(L3270A,I,O),(L3270B,,O,L3270C)
```

- Selection by VTAM terminal name is similar to selection by terminal symbolic name, except that, instead of symbolic name, the node names are specified.
- The first parameter is the node name or ALL.
- The second parameter, I, selects input from this terminal.
- The third parameter, O, selects output generated by input from this terminal.
- Output can be further qualified (similar to symbolic terminal output). If you specify ALL, all output from the terminal represented by the preceding name is selected.
- If an output message is queued but not sent, it is not selected, even if ALL is specified. The SYM NAME control statement must be used.

Time Control Statement

The format of the time control statement is:

```
TIME=(yyddd,hhmm[{+|-}HHMM],yyddd,hhmm[{+|-}HHMM])
```

- The first parameter is starting date—year (YY) and day of year (DDD).
- The second parameter is starting time—hours (HH) and minutes (MM) plus the optional time-zone offset information—{+|-}HHMM.
- The third parameter is ending date—year (YY) and day of year (DDD).
- The fourth parameter is ending time—hours (HH) and minutes (MM) plus the optional time-zone offset information—{+|-}HHMM.

  The optional time-zone parameters used in the second and fourth parameters are as follows:

  - The {+|-} is the sign of the time-zone offset from Universal Time Coordinated (UTC).
  - The HH is the number of whole hours of offset from UTC.
  - The MM is the minutes of offset; can be 00, 15, 30, 45, or blank.
- If you include the time control statement, only messages specified by a transaction code statement or a terminal control statement and falling within the specified times are selected.

Nonprintable Character Control Statement

The format of the nonprintable character control statement is:

```
NON PRINT=HEX
```

If you include this control statement, nonprintable characters are printed in hexadecimal, on two lines, with one hexadecimal character above the other. If you do not include this statement, nonprintable characters appear as blanks.

Part 5. Interpreting IMS Reports

Chapter 18. Interpreting IMS Monitor Reports

This chapter describes:

- The events that the IMS Monitor collects
- The content of the reports produced by the IMS Monitor Report Print Program

The IMS Monitor output reflects the IMS DB/DC environment as a whole. A subset of the reports deals with database calls and buffering. Interpreting this data for batch application performance and to verify database design are considered separate tasks allied with database administration.

Related Reading: For more information on these reports, see *IMS Version 9: Utilities Reference: Database and Transaction Manager*.

The following topics provide additional information:

Transaction Flow and IMS Monitor Events

For an overall picture of the events, system activities, and usage of storage areas (buffer pool or data set) for which the IMS Monitor gathers timings, see Table 27. The leftmost column shows, from top to bottom, a sequence of processing events; each event is related to IMS Monitor reported items in the notes that follow the table.

Table 27. Transaction Flow and IMS Monitor Events Description

Flow	Event	Activity	Pool	Data Set
1	Wait for poll	Waiting	N/A	N/A
2	Data Transfer	N/A	N/A	N/A
3	Input message processing	Device	CIOP	(For lines)
		MFS	MFP	IMS.FORMATx
		Enqueuing	QBUF	Message queue
4	Input queuing	Waiting	N/A	N/A

Table 27. Transaction Flow and IMS Monitor Events Description (continued)

Flow	Event	Activity	Pool	Data Set
5	Scheduling	Scheduling	QBUF	Message queue
		PSB load	PSB, PSBW, DPSB	IMS.ACBLIBx
		DMB load	DMBP	IMS.ACBLIBx
6	Program load	Program load		IMS.PGMLIB
7	Program initialization	Initializing	N/A	N/A
8	Message queue GU	Primed GU call	N/A	N/A
9	Program Execution	DC calls	QBUF	Message queue
	DL/I Elapsed	DB calls	OSAM/VSAM	N/A
	Wait Elapsed	DB I/Os	OSAM/VSAM	Databases
		SPA insert	CWAP	IMS.SPA
10	Output message insert	DC ISRT call	QBUF	Message queue
		DC GU call	QBUF	Message queue
		Sync point (MODE=SNGL)	OSAM/VSAM	Databases
11	Wait for sync point	(Only for MODE=MULT)	N/A	N/A
12	Program termination	Program termination	OSAM/VSAM	Databases
13	Wait for selection	Waiting	QBUF	Message Queue
14	Output message processing	Message send	QBUF	Message queue
		MFS	MFP	IMS.FORMATx
		Device	CIOP	(For lines)
15	Data transfer	N/A	N/A	N/A
16	Output queue processing	Dequeuing	QBUF	Message queue

Notes to Table 27:

1. The time waiting for poll is not recorded by the IMS Monitor.
2. Line activity in terms of data transmitted and IMS communication sub-task activity are recorded for all messages. Input message activity is not separated from output message activity.
3. During input message processing, the device dependent processing and the use of the communication I/O pool (CIOP) are recorded. If message format service (MFS) is required, the use of the message format buffer pool and any I/O to the active IMS.FORMATA/B library are recorded. The input message is then placed in a message queue buffer (QBUF) with possible I/O to the message queue data sets. The IMS Monitor reporting does not distinguish this activity from output message processing.
4. Time spent waiting on the input queue is not recorded by the IMS Monitor.
5. IMS schedules the processing program into a region and, as part of this action, accesses the message queue or the QBUF pool so that it can present the message to the program. At this time, the required PSB and physical database blocks are made available in the PSB pool and the DMB pool. If they are not already in the pool, they are retrieved from the active IMS.ACBLIBA/B data set. These events are summarized under `SCHEDULING AND TERMINATION` in IMS Monitor reports.

6. Next, the application program is loaded into the region from IMS.PGMLIB, or initialized if already resident in the region. This processing is included as part of SCHEDULE TO FIRST CALL in IMS Monitor reports.
7. The initialization performed by the application program is included in this period of time, up to the time of the first message queue or database call. This processing is considered part of the scheduling process because it is not repeated when multiple transactions are processed for one scheduling event. This processing is recorded as part of the SCHEDULE TO FIRST CALL in IMS Monitor reports.
8. The event of performing the first DL/I GU call to obtain the first message segment is not separately recorded. The processing to prime the application with this message is included with the SCHEDULE TO FIRST CALL.
9. The program elapsed event is measured from the first call to termination of the processing program. The total elapsed time is recorded in IMS Monitor reports as ELAPSED EXECUTION.
   - Each DL/I call, whether DC or DB, is individually recorded along with its use of message queues or database data sets and their respective pools. Each external subsystem call is individually recorded. These events are recorded under CALLS in IMS Monitor reports.
   - When a DL/I call causes I/O activity, the time spent waiting for the data is recorded as WAIT time and as the number of I/Os. When a program's database processing intent and other update activity are in contention, this also contributes to WAIT time. For each external subsystem call, the time spent in external subsystem processing is recorded separately as WAIT time. When processing is suspended because of intent, the elapsed time is recorded in IDLE FOR INTENT IMS Monitor report items. When processing is suspended because the region is designated as wait-for-input and no input message is available, the time spent waiting for the next input message is excluded from elapsed time intervals and wait times. Wait-for-input time appears only in **WFI items on the program I/O report.
   - If the message processing is part of a conversational transaction, the activity in the communications work area pool (CWAP) and the IMS.SPA data set is recorded.
10. The DL/I ISRT call for the response to the message just processed is recorded for the transaction.

    As processing continues, there are synchronization points such as a GU to the message queue for another input message or a checkpoint call. The database and message queue I/O to commit the program processing is recorded. Checkpointing by IMS or by the processing program is recorded separately.
11. If the processing is for multiple messages before synchronization (MODE=MULT), there can be a wait for sync point. This time is not recorded by the IMS Monitor.
12. The processing after exiting from the application program, the program termination events, is included with the initial scheduling time. It is part of SCHEDULING AND TERMINATION.
13. The output message waits for the selection to be transmitted to the terminal. The duration of any wait time on the output queue is not recorded by the IMS Monitor.
14. After the exit from the application program and termination, output message processing events are recorded. These include message format and device dependent processing as well as sending the output message. The IMS Monitor reporting does not distinguish this activity from input message processing.

15. Line activity in terms of data transmitted and IMS communication sub-task activity are recorded for all messages. Output message activity is not separated from input message activity.
16. The processing to remove the output message from the queue is recorded.

IMS Monitor Trace Event Intervals

The IMS Monitor trace interval is bounded by the master terminal operator's use of the /TRACE command between the start and stop command entries. The IMS Monitor can also be stopped by the expiration of any interval specified. The online IMS events are recorded in IMS Monitor records placed in the IMSMON data set. The event timings are related to dependent region activity. Figure 129 shows the boundaries of the timed event intervals.

The Monitor trace interval includes the following intervals:

- Scheduling and Termination
  - No Messages
  - Block loader busy
  - Intent failures (exclusive intent and data sharing) and Schedule failures (PSB busy and space failure)
  - Sched/Term elapsed
    - NOT-WAIT
    - ACBLIB waits
    - DB Flush waits
    - DB CLOSE waits
- Region occupancy (which overlaps with all of Sched/Term elapsed)
  - Schedule to first call
  - Elapsed execution

The NOT-WAIT time for a region is the elapsed time not accounted for by wait time. Any delay coming from either paging or the processor being dispatched for a higher priority task results in an increase in the NOT-WAIT times.

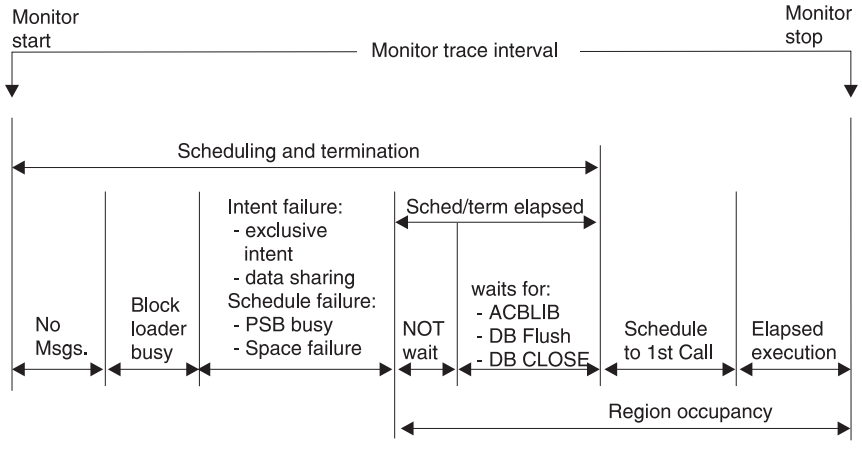


Figure 129. IMS Monitor Trace Event Intervals

Overview of IMS Monitor Reports

A list of reports available from data collected by the IMS Monitor, together with the principal performance data they contain, is shown in Table 28.

Related Reading: For those reports marked by a "DB", see *IMS Version 9: Utilities Reference: Database and Transaction Manager*.

The reports marked "MSC" in the list are only produced when MSC is active. The MSC reports and their interpretation are in "Interpreting IMS Monitor MSC Reports" on page 414.

Sequence of Report Output

The order of the reports listed in Table 28 matches the sequence of the output from the IMS Monitor Report Print Program. The duration or constraints of a monitoring snapshot might not include certain events necessary for an individual report, in which case only report headings or partial data are produced.

Table 28. IMS Monitor Reports Output Sequence and Information

Report Name	Principal Information
System Configuration	Monitor run documentation
Message Queue Pool	Buffering and message I/O per transaction
Database Buffer Pool (DB)	Count of DB calls and I/O per transaction
VSAM Buffer Pool (DB)	Count of inserts and I/Os
Message Format Buffer Pool	Count of blocks fetched and I/Os
Latch Conflict Statistics	IMS internal processing
General Wait Time Events	Wait times for SNAPQ
Region and Jobname	Monitor run documentation
Region Summary	Elapsed times and count of DL/I calls
Region Wait	Wait times
Programs by Region	Elapsed times for region usage
Program Summary	Overall program statistics
Program I/O (DB)	Wait times/PCB
Communication Summary	Elapsed times for lines
Communication Wait	Wait times by line
Line Functions	Count and size of blocks transmitted
MSC Traffic (MSC)	Count and routing of transactions
MSC Summaries (MSC)	Count of transactions by destination
MSC Queuing Summary (MSC)	Count and queuing time by link
Transaction Queuing	Queue loading statistics
Reports	Count of space failures and deadlocks
Run Profile	Monitor run documentation
Call Summary (DB)	Call counts and timings/segment type
Distribution Appendix	Event frequency distributions

Units of Measure in IMS Monitor Reports

The majority of the data items in IMS Monitor reports are elapsed times. These are normally expressed in microseconds. An entry of 1876534 represents 1.876534 seconds or 1876 milliseconds. Any times that do not follow this convention show the unit of measure on the report.

You can also find counts of events under the heading OCCURRENCES, and some figures that represent the number of bytes.

Documenting the Monitoring Run

For each trace interval there are several general reports or overall summaries of the processing that took place. You can use these reports as part of your IMS Monitor run documentation.

It is important to record, as accurately as possible the conditions under which the trace was taken. Your documentation can include system status information obtained by the /DISPLAY command several times before and after the trace, an expected profile of the application program activity, and any desired processing events. The trace interval should represent typical processing loads and not be a biased or inadequate historical record.

Adding to the System-Configuration Report Data

The first general report titled SYSTEM CONFIGURATION is found under the page heading BUFFER POOL STATISTICS. It shows the modification level of the IMS and z/OS systems. The system configuration output is illustrated in Figure 130.

Recording the Monitor Trace Interval

The heading of most IMS Monitor reports carries the trace start and stop times. It is shown in the format YEAR DAY (Julian) HH:MM:SS. The overall length of the trace interval is given in milliseconds under the title MONITOR OVERHEAD DATA. The following line shows how many trace records were placed on the IMSMON data set. An example of the monitor trace interval recording is shown in Figure 130.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0001

                S Y S T E M  C O N F I G U R A T I O N


                                        SYSTEM CONFIGURATION      :
                                           IMS VERSION            :   4
                                        RELEASE LEVEL             :
                                        MODIFICATION NUMBER       :
```

Figure 130. IMS Monitor-System-Configuration Report and Trace Interval

Completing the Monitor Run Profile

A compact set of processing ratios is found at the end of the Run-Profile report. The statistics summarize, for the monitor interval, the transaction throughput and the degree of DL/I and I/O activity. An example of the report is shown in Figure 131 on page 387.

The lower part of the Run-Profile report shows several ratios:

Program elapsed time to DL/I elapsed time for each region

DL/I elapsed time to wait time during DL/I processing

Program elapsed time to other subsystem call elapsed time

DL/I elapsed time to other subsystem call elapsed time

Each dependent region is identified by a sequence number, starting at region 1.

```
     IMS MONITOR   **RUN PROFILE**                    TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0184
TRACE ELAPSED TIME IN SECONDS.............274.6
TOTAL NUMBER OF MESSAGES DEQUEUED........1403
TOTAL NUMBER OF SCHEDULES.................173
NUMBER OF TRANSACTIONS PER SECOND...........5.1
TOTAL NUMBER OF DL/I CALLS ISSUED.......18632
NUMBER OF DL/I CALLS PER TRANSACTION.......13.2
NUMBER OF OSAM BUFFER POOL I/O'S........11236,    8.0 PER TRANSACTION
NUMBER OF MESSAGE QUEUE POOL I/O'S..........0,    0.0 PER TRANSACTION
NUMBER OF FORMAT BUFFER POOL I/O'S..........0,    0.0 PER TRANSACTION
RATIO OF PROGRAM ELAPSED TO DL/I ELAPSED:
               REGION   1:   1.09
               REGION   2:   1.09
               REGION   3:   1.00
               REGION   4:   1.02
               REGION   5:   1.01
               REGION   6:   1.00
               REGION   7:   1.00
               REGION   8:   1.00
               REGION   9:   1.17
               REGION  10:   1.00
               REGION  11:   1.00
               REGION  49:   1.03
               REGION  50:   1.19
RATIO OF DL/I ELAPSED TO DL/I IWAIT:
               REGION   1: 325.65
               REGION   2:  73.49
               REGION   4: 100.35
               REGION   5:  85.76
               REGION   6:  82.99
               REGION  47:  95.64
               REGION  48:  45.93
               REGION  49:   9.22
```

Figure 131. Run-Profile Report

You can match the regions to the name of the z/OS job using the Region-and-Jobname report. The job names correspond to the step names on the EXEC statements of all the dependent regions started by the operator before the trace was started. The region job names are included on the monitor output page with the heading GENERAL REPORTS, as illustrated in Figure 142 on page 402.

Some generalized processing ratios are given at the end of several buffer pool statistics reports. You can include them in the documented profile of the trace interval. These are not specific to one application or system resource but can be used as indicators of variation across a series of monitor runs.

The ratios are:

- The total number of OSAM reads + OSAM writes + all waits divided by the total number of transactions.

  From the Message-Queue-Pool report (see Figure 141 on page 401), this ratio indicates on a per transaction basis the physical I/O activity required to handle the message queuing function.
- The total number of OSAM reads + OSAM writes + BISAM reads divided by the total number of transactions.

  From the Database-Buffer-Pool report (see Figure 144 on page 404), this ratio indicates on a per transaction basis the physical I/O activity required to handle the database buffering function.
- The total prefetch I/Os + immediate fetch I/Os + directory I/Os divided by the total number of transactions.

From the Message Format Buffer Pool report (see Figure 140 on page 401), this ratio indicates on a per transaction basis the physical I/O activity required to handle the MFS function.

Verifying IMS Monitor Report Occurrences

When you examine the output from the IMS Monitor Report Print program, the presence of a report heading does not necessarily mean that appropriate data is listed. System definition options and utility control statements affect the content of the output as follows:

- The output does not include a Call-Summary report unless a control statement specifies `DLI`.
- The output does not include a set of Distribution reports unless a control statement specifies `DIS` or `DISTRIBUTION`. The column headed `DISTRIBUTION NUMBER` that occurs on many of the reports contains cross-references to items included in the Distribution reports.
- The output consists of just a Call Summary report if a control statement specifies `ONLY DLI`.

Because many of the summary reports require system status to calculate the difference between start and end values, and this status is obtained during the `/TRACE SET OFF` processing, the IMS Monitor execution must end before termination of the IMS control region. If the trace was not stopped properly, the following message is issued:

```
NO QUEUE BUFFER POOL TRACES AT END TIME ON MONITOR LOG TAPE
****QUEUE BUFFER POOL REPORT CANCELLED****
```

Similarly, other summary reports are not produced.

The series of reports with the title `BUFFER POOL STATISTICS` do not include a `VSAM BUFFER POOL` section unless one of the databases in IMS.ACBLIB uses the VSAM access method. If VSAM is not used, the following message is issued:

```
NO VSAM BUFFER POOL TRACES ON MONITOR LOG TAPE
****VSAM BUFFER POOL REPORT CANCELLED****
```

The section `MESSAGE FORMAT BUFFER POOL` is included only if your system definition specifies devices using Message Format Service.

If the source data used to formulate a particular IMS Monitor report, or a section of that report, has not been recorded by the IMS Monitor during the trace interval, the report contains only the headings.

Monitoring Activity in Dependent Regions

The IMS Monitor gathers timing information for every dependent region identified in the /trace command active during the trace interval. It records the total of the elapsed times for each event, the maximum individual time encountered, and the average time.

There are three major reports that display timings. The reports and a list of their content are:

- **Region-Summary Report**
  - Scheduling and termination
  - Schedule end to first call
  - Elapsed execution with separate summaries shown for:

    - DL/I calls
    - External subsystem service and command calls
    - External subsystem database access calls
    - Checkpoint processing
    - Region occupancy
- **Region Wait**
  – Waits during scheduling and termination
  – Waits during DL/I calls
  – Waits during external subsystem calls
  – Waits during checkpoint
- **Programs by Region**
  – Elapsed execution
  – Schedule end to first call

These three reports are illustrated in Figure 132 on page 390, Figure 133 on page 391, and Figure 134 on page 392.

Activities for dependent regions are placed in five categories:

- Elapsed time for scheduling and termination

  The scheduling process includes many preparatory events such as block loading from an active IMS.ACBLIBA/B data set, and obtaining ownership of the PSB. The time required to terminate the region activity after the application program ends is also included.
- Elapsed time from end of schedule to first call

  This time is reserved for application program initialization and housekeeping prior to an initial call (to the message queue, a database, or an external subsystem) that marks the beginning of control program services. It is a measure of processing that is not repeated when multiple transactions are processed in a single scheduling.
- Program elapsed time, including all calls

  This time encompasses the major application program processing, measured from the first call to the return or exit from the program.
- Elapsed time performing DL/I calls

  This time includes all DL/I calls. Each DL/I call event is measured from the time of the call to the return to the application program.
- Elapsed time performing external subsystem calls

  This time includes all external subsystem calls. Each external subsystem event is measured from the time of the call to the return to IMS.

```
     IMS MONITOR   ****REGION SUMMARY****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0011
                                              (A)                                  (B)
                                   .........ELAPSED TIME.........       NOT IWAIT TIME(ELAPSED-IWAIT)                DISTRIBUTION
                OCCURRENCES        TOTAL        MEAN     MAXIMUM        TOTAL        MEAN     MAXIMUM                   NUMBER
                ___________        _____        ____     _______        _____        ____     _______                   ______
SCHEDULING AND TERMINATION
_________ ___ ___________
**REGION     5           5         4146         829         948         4146         829         948                    287A,B
**REGION     6           7         6028         861        1067         6028         861        1067                    214A,B
**REGION     8           8         6847         855        1098         6847         855        1098                    129A,B
**REGION    10           7         9664        1380        3668         9664        1380        3668                    272A,B
**REGION    47           6         5482         913        1021         5482         913        1021                    145A,B
**REGION    49           3         2612         870         917         2612         870         917                    443A,B
**TOTALS               123       126042        1024                    126042        1024
SCHEDULE TO FIRST CALL
________ __ _____ ____
**REGION     1           1     15479797    15479797    15479797                                                        555
**REGION     2           1     22376350    22376350    22376350                                                        564
**REGION     3           1     15169488    15169488    15169488                                                        578
**REGION     4           1     48146258    48146258    48146258                                                        584
**REGION    48           1       795351      795351      795351                                                        592
**REGION    49           4      2960425      740106     2951746                                                        442
**REGION    50           1     15713464    15713464    15713464                                                        575
**TOTALS               168    514286738     3061230
ELAPSED EXECUTION
_______ _________
**REGION     1           1    290146255   290146255   290146255                                                          1
**REGION     2           1    252290108   252290108   252290108                                                          2
**REGION     3           1    259496970   259496970   259496970                                                          3
**REGION     4           1    322812716   322812716   322812716                                                          4
**REGION    48           1    273871107   273871107   273871107                                                         48
**REGION    49           4    271703421    67925855   155176058                                                         49
**REGION    50           1    290379922   290379922   290379922                                                         50
**TOTALS               173  14238540145    82303700
DL/I CALLS                                                                                                 IWT/CALL(C)
____ _____                                                                                                 _________
**REGION     1          60    264626241     4410437    88981490   263813671     4396894    88970053          0.76      247A,B,C
**REGION     2         223    230505269     1033655    61048758   227368742     1019590    61011153          0.73      237A,B,C
**REGION     3          29    257704383     8886358    69000514   257704383     8886358    69000514          0.00       98A,B,C
**REGION     4         792    313735347      396130    52439653   310609035      392183    52439653          0.22      180A,B,C
**REGION    49         592    262886317      444064    30202068   234394017      395935    30159782          2.46      177A,B,C
**REGION    50          36    242591451     6738651    48651260   242591451     6738651    48651260          0.00      289A,B,C
**TOTALS             18632  12386905286      664818            12024562411      645371                      0.97
IDLE FOR INTENT
____ ___ ______
                      NONE
CHECKPOINT
__________
                      NONE
REGION OCCUPANCY
______ _________
**REGION     1    100.0%
**REGION     2    100.0%
**REGION     3    100.0%
**REGION     4    100.0%
**REGION    48    100.0%
**REGION    49    100.0%
**REGION    50    100.0%
```

Figure 132. Region-Summary Report

```
     IMS MONITOR   ****REGION IWAIT****               TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0023
                                .........IWAIT TIME.........                                DISTRIBUTION
**REGION     5 OCCURRENCES       TOTAL        MEAN     MAXIMUM       FUNCTION  MODULE       NUMBER
  ______      ___________       _____        ____     _______       ________  ______       ______
SCHEDULING + TERMINATION
_________  ___________
   SUB-TOTAL
   _________
   TOTAL
   _____
DL/I CALLS
____ _____
                      11      181816       16528       24375    DD=IMMSTR2A   DBH            117
                       8      112831       14103       17846    DD=IMMSTR1A   DBH            118
                       5       85460       17092       33717    DD=IMMSTR3A   DBH            119
                       5       58420       11684       14643    DD=IMINDEXA   VBH            120
                      12      173866       14488       22152    DD=PRODCNTA   VBH            121
                       3      100576       33525       68373    DD=IMMSTR2B   DBH            428
                       1       17921       17921       17921    DD=IMMSTR3B   DBH            429
                       1       17195       17195       17195    DD=IMMSTR1B   DBH            430
                       1       13577       13577       13577    DD=IMINDEXB   VBH            431
                       3       49928       16642       20396    DD=PRODCNTB   VBH            432
                       4       10973        2743        2787    DD=ITEMACTB   DBH            453
                       2       37680       18840       27664    DD=IAINDEXB   VBH            454
                      49     1500067       30613      138284    DD=INVENTRA   DBH            472
                      23      345595       15025       27613    DD=VENDORDA   VBH            473
                       1      342952      342952      342952    PI=VENDORDA...1              498
                       1       14612       14612       14612    PI=VNSINDXA...1              499
                       6       69203       11533       19492    DD=VNSINDXA   VBH            500
   TOTAL
   _____             136     3132672       23034
```

Figure 133. Region-Wait Report

```
     IMS MONITOR   ****PROGRAMS BY REGION****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0069
                                                (A)                                  (B)
                                  ELAPSED EXECUTION TIME            SCHEDULING END TO FIRST CALL      DISTRIBUTION
                OCCURRENCES       TOTAL        MEAN     MAXIMUM       TOTAL        MEAN     MAXIMUM       NUMBER
                ___________       _____        ____     _______       _____        ____     _______       ______
**REGION     1
________ _ 1
    PROGSC6D            1   290146255   290146255   290146255    15479797    15479797    15479797         885A,B
 REGION TOTALS          1   290146255   290146255                15479797    15479797
**REGION     2
________ _ 2
    PROGIT8C            1   252290108   252290108   252290108    22376350    22376350    22376350         889A,B
 REGION TOTALS          1   252290108   252290108                22376350    22376350
**REGION     3
________ _ 3
    PROGTS1C            1   259496970   259496970   259496970    15169488    15169488    15169488         893A,B
 REGION TOTALS          1   259496970   259496970                15169488    15169488
**REGION     4
________ _ 4
    PROGPS3D            1   322812716   322812716   322812716    48146258    48146258    48146258         897A,B
 REGION TOTALS          1   322812716   322812716                48146258    48146258
**REGION     5
________ _ 5
    PROGPS3A            2    62893103    31446551    40693590        5435        2717        2862         901A,B
    PROGTS1B            1    61794787    61794787    61794787        2790        2790        2790        1271A,B
    PROGPS3B            1    18294458    18294458    18294458        3104        3104        3104        1350A,B
    PROGIT2B            1    36095342    36095342    36095342        2731        2731        2731        1363A,B
    PROGSC2A            1    93902771    93902771    93902771     1667791     1667791     1667791        1401A,B
 REGION TOTALS          6   272980461    45496743                 1681851      280308
**REGION     6
________ _ 6
    PROGIT1B            2    39000315    19500157    23703429        5286        2643        2801         905A,B
    PROGTS1B            1    34293636    34293636    34293636        3136        3136        3136        1207A,B
    PROGPS3A            1    51887767    51887767    51887767        2534        2534        2534        1278A,B
    PROGPS3B            2    67375031    33687515    40291430    17210570     8605285    17213287        1328A,B
    PROGIT8A            1    69132416    69132416    69132416        3291        3291        3291        1359A,B
    PROGSC4A            1    30165017    30165017    30165017        2571        2571        2571        1433A,B
 REGION TOTALS          8   291854182    36481772                17193752     2149219
**REGION     7
________ _ 7
    PROGSC2B            1   269618583   269618583   269618583     5047875     5047875     5047875         909A,B
 REGION TOTALS          1   269618583   269618583                 5047875     5047875
**REGION     8
________ _ 8
    PROGIT8A            1     5181039     5181039     5181039        2928        2928        2928         913A,B
    PROGPS3A            1    27304257    27304257    27304257        3350        3350        3350        1132A,B
    PROGSC4B            1    37286872    37286872    37286872        3009        3009        3009        1255A,B
    PROGIT2A            1    36902995    36902995    36902995        2850        2850        2850        1298A,B
    PROGIT1B            1    30407479    30407479    30407479        2565        2565        2565        1336A,B
    PROGIT1A            3   109875360    36625120    45190114     4279008     1426336     4272096        1357A,B
    PROGIT8B            1    23405220    23405220    23405220        2679        2679        2679        1395A,B
 REGION TOTALS          9   270363222    30040358                 4296389      477376
```

Figure 134. Programs-by-Region Report

Detecting Database Processing Intent Conflicts

The IMS Monitor records the intervals when a region is in an idle state waiting to update a database owned exclusively by another already scheduled application program.

You can see the total, maximum, and average idle times in `IDLE FOR INTENT` following the DL/I calls. The elapsed time during the unsuccessful scheduling of a program in that region is included in the summary line times for that region.

The region can fail to be scheduled even when ownership of that database is released. The number of times processing is held up by intent failure is separately tallied under the title `INTENT FAILURE SUMMARY`. The report is illustrated in Figure 135 on page 393. In this report you can see which PSBs are in conflict because of exclusive intent for a segment type and the database name in question.

```
INTENT FAILURE SUMMARY
    PSBNAME        DMBNAME       OCCURRENCES
    SSTPSBNM       SSTDMBNM            1
    TOTAL                              1
```

Figure 135. Intent-Failure-Summary Report

Examining the Effects of Checkpoints

The checkpoint line of the Region Summary report at the end of the region—by—region summary, shows the following:

- The number of times that a system checkpoint was taken during the monitor interval
- The elapsed times
- The not-wait times

Checkpoint processing can be initiated by the control program at a specified frequency determined by the number of records placed on the system log. Other checkpoints can be caused by operator commands.

The wait time experienced during checkpoints is reported at the end of the first region summary on the Region Wait report. You can detect delays for each combination of ddname and module code. Typical entries here are for the message queue data sets and the restart data set. If a wait for storage is the cause, the entry under the `FUNCTION` column is `STG.=` followed by the identification of the pool.

Measuring Region Occupancy

A measure of region activity is the percentage of region occupancy. This is broadly the ratio of the elapsed time a region is performing processing to the trace interval. The region occupancy time does not include those times when no messages are available, when the block loading is delayed, or when the PSB cannot be used. The last section in the Region Summary report lists all active regions for which timed events were collected and shows the calculated percentages of region occupancy.

Monitoring Application Program Elapsed Time

The IMS Monitor can record measurements of elapsed times for each transaction and scheduling of an application program. It does this during the monitored interval while other programs are executing concurrently. Elapsed times are calculated from the start of the first DL/I (or other) call to the end of that program. You can distinguish between time spent in application code and in DL/I processing. Figure 136 on page 394 illustrates the event intervals.

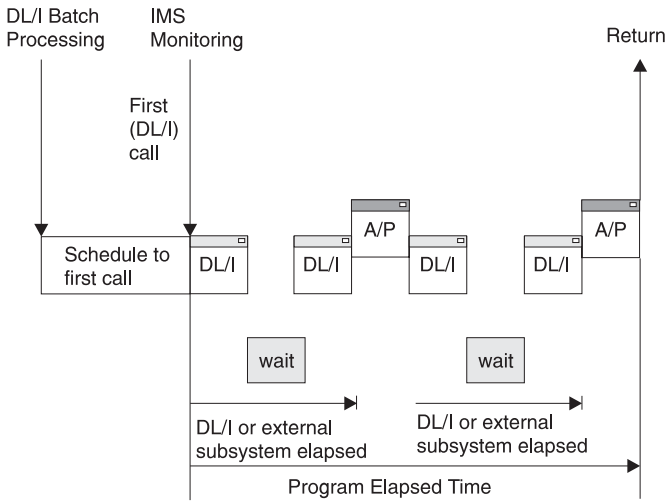


Figure 136. Event Intervals for Time in Application Code and DL/I Processing

Within the elapsed time for a DL/I call, the wait time to obtain segment data is recorded separately. Similarly, within the elapsed time for an external subsystem call, the processing time in the external subsystem is recorded separately as the wait time. For regions designated as wait-for-input, the time spent waiting for input messages is excluded from values shown in the reports. The application processing (A/P) time includes many kinds of subsidiary service beyond the machine cycles expended by the program object code—such as subroutine loading, I/O to z/OS data sets, and any overlay processing. If the program is waiting to be dispatched or requires paging before it can use real storage, these delays are also accounted for in application program processing time. Because a program can execute many transactions for each schedule, the elapsed time from schedule to first call is recorded separately. This time covers the initialization performed by the application program and includes the time for loading the program.

The elapsed times are given in the Program Summary report. Figure 137 on page 395 is an example of the report. Programs are identified by their PSB name on individual lines in the report. Each line gives a summary of the activity for that PSB during the measured interval. The total number of schedules, DL/I calls, transactions completed (dequeued), and waits for DL/I call I/O and external subsystem processing are given. The report line gives calculated average times for:

- Elapsed time per schedule
- Processor time per schedule
- Schedule to first DL/I call per schedule
- Elapsed time per transaction

The report also includes:

- Frequencies for calls per transaction
- I/O waits per DL/I call
- Waits per external subsystem call
- Transactions dequeued per schedule

A `TOTALS` line summarizes all activity for the PSBs active during the monitored interval. (The `PSB DUMMY` line reconciles any incomplete scheduling caused by a

region stopping during scheduling or for a program that experiences a pseudo abend.)

```
     IMS MONITOR   ****PROGRAM SUMMARY****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0075
                                                          (A).....(B).....                  (A).....(B).....
                                                  I/O   TRAN.      CPU       .      ELAPSED    SCHED.TO    .       ELAPSED
            NO.    TRANS.          CALLS   I/O   IWAITS DEQD.     TIME    DISTR.    TIME      1ST CALL  DISTR.     TIME
PSBNAME  SCHEDS.    DEQ.    CALLS  /TRAN  IWAITS  /CALL /SCH.   /SCHED.    NO.    /SCHED.    /SCHED.    NO.     /TRANS.
_______  _______   _____   _____  _____  ______  _____ _____   _______   ____   _______    _______   ____    _______

PROGSC6D       1      13      60    4.6      46    0.7  13.0     10010   884A,B  290146255   15479797  886A,B   22318942
PROGIT8C       3      17     225   13.2     166    0.7   5.6     90592   888A,B  256617508   73283259  890A,B   45285442
PROGTS1C       2      25      47    1.8       0    0.0  12.5     10010   892A,B  239190808    7586234  894A,B   19135264
PROGPS3D       1      23     792   34.4     182    0.2  23.0     10010   896A,B  322812716   48146258  898A,B   14035335
PROGPS3A      13      36    1246   34.6     267    0.2   2.7     49782   900A,B   32801812    2228611  902A,B   11845098
PROGIT1B      11      21      99    4.7       0    0.0   1.9      6341   904A,B   23212388    2036217  906A,B   12158870
PROGSC2B       7     155    3068   19.7    1845    0.6  22.1    346112   908A,B   93655514     789390  910A,B    4229603
PROGIT8A      12      28     434   15.5     293    0.6   2.3     34350   912A,B   30196795    1745815  914A,B   12941483
PROGPS2C       1      10     179   17.9     205    1.1  10.0     10010   916A,B  221024429   53642029  918A,B   22102442
PROGTS1B       8      20      54    2.7       0    0.0   2.5      5447   920A,B   39943245       2895  922A,B   15977298
PROGPS3C       1      14     468   33.4     117    0.2  14.0     10010   924A,B  310644485   35978027  926A,B   22188891
PROGIT1C       1       9      32    3.5       0    0.0   9.0     10010   930A,B  304892631   30226173  932A,B   33876959
PROGSC2C       1       9     160   17.7     101    0.6   9.0     10010   934A,B  296909110   22242652  936A,B   32989901
PROGIT2B       8      21     393   18.7      63    0.1   2.6     21703   938A,B   35126671    1798496  940A,B   13381589
PROGIT2C       6      17     211   12.4      39    0.1   2.8     13312   942A,B  288883508   50698467  944A,B  101958885
PROGTS1D       2      26      50    1.9       0    0.0  13.0     10010   950A,B  284944505   10613350  952A,B   21918808
PROGPS3B       8      22     770   35.0     169    0.2   2.7     35737   954A,B   38016279    2149158  956A,B   13824101
PROGIT1A      11      24     106    4.4       0    0.0   2.1      7925   958A,B   30883486    1935855  960A,B   14154931
PROGSC4A       9     163    1775   10.8    5101    2.8  18.1    235921   963A,B   62172947    3011199  965A,B    3432862
PROGSC6C       1      10      44    4.4      38    0.8  10.0     10010   967A,B  228098334   46568124  969A,B   22809833
PROGPS2B      11      28     557   19.8     604    1.0   2.5     35069   971A,B   33309266    1181831  973A,B   13085783
PROGIT8D       1      12     175   14.5     133    0.7  12.0     10010   975A,B  253392289   21274169  977A,B   21116024
PROGSC4C       1      10      98    9.8     349    3.5  10.0     10010   979A,B  248736332   25930126  981A,B   24873633
PROGSC6A       7     157     789    5.0     457    0.5  22.4     11703   983A,B   73936039     115979  985A,B    3296511
PROGIT2A       7      22     430   19.5      71    0.1   3.1     28529   987A,B   37905001       2982  989A,B   12060682
PROGSC2D       1      15     280   18.6     180    0.6  15.0     10010   991A,B  316194222   41527764  993A,B   21079614
PROGPS2A       6      25     490   19.6     548    1.1   4.1     43177   995A,B   58277945    2467506  997A,B   13986707
PROGSC2A       5     121    2363   19.5    1420    0.6  24.2    276187  1001A,B   88906184    6022954 1003A,B    3673809
PROGIT2D       1      20     361   18.0      62    0.1  20.0     10010  1005A,B  386092737  111426279 1007A,B   19304636
PROGSC4B      10     131    1421   10.8    4115    2.8  13.1    617016  1011A,B   53826667    2632409 1013A,B    4108905
PROGSC4D       1      19     197   10.3     668    3.3  19.0     10010  1020A,B  227999124   46667334 1022A,B   11999953
PROGPS2D       1      13     240   18.4     291    1.2  13.0     10010  1025A,B  327602445   52935987 1027A,B   25200188
PROGSC6B       5     140     694    4.9     395    0.5  28.0     16884  1032A,B   78994223    3290769 1034A,B    2821222
PROGIT1D       1      10      36    3.6       0    0.0  10.0     10010  1041A,B  290379922   15713464 1043A,B   29037992
PROGIT8B       8      17     288   16.9     190    0.6   2.1     33436  1259A,B   35223857       2902 1261A,B   16575932
**TOTALS     173    1403   18632   13.2   18115    0.9   8.1     90328            82303700    2972755          10148638
```

Figure 137. Program-Summary Report

You can use the Call-Summary report to examine the detail of the call processing for each program. The report is itemized by type of call and summarized for the monitor interval. An extract from the multipage output is given in Figure 138 on page 396. The calls using an I/O PCB are given first and subtotaled. Then, the total calls of each type, against each database PCB and each external subsystem, are listed. The `PSB TOTAL` line marks the end of data for each program.

```
     IMS MONITOR   ****CALL SUMMARY****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0186
                                                                  (C)              (A)                    (B)
                   CALL  LEV          STAT                      IWAITS/       ..ELAPSED TIME...       .NOT IWAIT TIME..   DISTRIB.
PSB NAME PCB NAME  FUNC  NO.SEGMENT   CODE   CALLS     IWAITS   CALL         MEAN      MAXIMUM       MEAN      MAXIMUM    NUMBER
________ ________  ____  ________    ____   _____     ______   ____         ____      _______       ____      _______    ______
PROGSC6B I/O PCB   ISRT (  )                138          0     0.00          372        1240          372        1240       598A,B,C
                   GU   (  )                134        133     0.99      2600917    20974615      2587532    20962866       602A,B,C
                   (GU) (  )                  3          0     0.00           15          16           15          16       716A,B,C
                   ASRT (  )                  3          0     0.00          330         333          330         333       869A,B,C
                   GU   (  )          QC      2          1     0.50     17639806    21219588     17634776    21209529       870A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________         280        134     0.47      1370910                  1364469
          INVENTRB DLET (03)IN060SUP          138          0     0.00          813        1289          813        1289       599A,B,C
                   GNP  (03)IN060SUP          138          7     0.05         2112      112589         1047      112589       600A,B,C
                   GU   (01)IN010PAR          138        254     1.84        29511       75356         1195       19229       601A,B,C
                   DL/I PCB SUBTOTAL
                   ____ ___ ________         414        261     0.63        10812                    1018
                   PSB TOTAL
                   ___ _____                 694        395     0.56       559555                  551114
PROGSC2A I/O PCB   ISRT (  )                118          0     0.00          381        1496          381        1496       603A,B,C
                   GU   (  )                114        284     2.49      3304809    21784513     3164423    21664181       632A,B,C
                   (GU) (  )                  2          0     0.00           17          18           17          18       781A,B,C
                   ASRT (  )                  3          0     0.00          367         444          367         444       871A,B,C
                   GU   (  )          QC      2          5     2.50     19931897    20045206     19799530    19925277       872A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________         239        289     1.20      1743339                  1675270
          LOGVENDA REPL (03)IN040SLQ          118          0     0.00          268         804          268         804       604A,B,C
                   GNP  (03)IN040SLQ          118          5     0.04          899       16995          218         305       605A,B,C
                   REPL (02)VN030PAR          826          0     0.00          805        1578          805        1578       606A,B,C
                   GNP  (02)VN030PAR          826        873     1.05        19321       94521          456        1363       607A,B,C
                   REPL (01)VN020REO          118         58     0.49         8879       48076          832        1682       623A,B,C
                   GU   (01)VN020REO          118        195     1.65        31688      360775         1300        1746       625A,B,C
                   DL/I PCB SUBTOTAL
                   ____ ___ ________        2124       1131     0.53        10145                     636
                   PSB TOTAL
                   ___ _____                2363       1420     0.60       185445                  170013
PROGSC2D I/O PCB   ISRT (  )                 14          0     0.00          377         621          377         621       608A,B,C
                   GU   (  )                 14         36     2.57     22360408    52048566     22221852    51901313       634A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________          28         36     1.28     11180393                 11111115
          LOGVENDD REPL (03)IN040SLQ          14          0     0.00          263         328          263         328       609A,B,C
                   GNP  (03)IN040SLQ          14          1     0.07         1407       16889          223         307       610A,B,C
                   REPL (02)VN030PAR          98          0     0.00          820        1015          820        1015       611A,B,C
```

Figure 138. Call-Summary Report

Monitoring I/O for Application Program DL/I Calls

The IMS Monitor report shows the total number of I/O occurrences and the total time the occurrences took for each application program executed during a monitored interval. The Program-I/O report gives these two totals for all PSBs active during the monitored interval and includes the detailed breakdown of the I/O wait time as it was incurred by each PCB used by the program. Figure 139 on page 398 shows an example of the report.

The report shows any contention experienced during application program processing. Each type of conflict and the number of times it occurred are recorded for each I/O PCB or database PCB. The report shows the total wait time, the highest wait experienced, and the average time. Subtotals are given for each PCB under a PSB, and for all PCBs under each PSB.

The DDN/FUNC column lists the data set ddname. The MODULE column uses a code to indicate the source of the contention. The types of conflicts and codes are shown as follows.

- **Message handling**

Code	Conflict
DBH	OSAM I/O for message queues
MFS	MFS format library directory
PMM	Message format buffer pool space or control block I/O

QMG	Message queue management

- **Scheduling**

Code	Conflict
BLR	Load/read from ACBLIB
MSC	MPP region initialization
SMN	Virtual storage management

- **Database access**

Code	Conflict
DBH	OSAM I/O
DLE	DL/I functions
VBH	VSAM interface
(Physical segment code)	Program isolation

For external subsystem calls, the elapsed time to complete the processing is considered wait time. The `DDN/FUNC` column indicates the external subsystem call function, as shown as follows:

- **External subsystems**

Code	Subsystem call function
AB0	ABORT
CT0	Create thread
D50	Terminate identify or thread, signoff
D80	INIT
I30	Identify, command, echo, terminate
I30	Identify, terminate subsystem
I50	INIT
I60	Resolve-in-doubt
PR0	Subsystem-not-operational
P10	Commit prepare (Phase 1)
P20	Commit continue (Phase 2)
SO0	Signon
SI0	Identify

```
     IMS MONITOR   ****PROGRAM I/O****               TRACE START 1993 022   14:00:18    TRACE STOP  1993 022  14:02:20  PAGE 0088
                                    .........IWAIT TIME..........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR1A I/O PCB          122     2341116       19189       70795   HOTELDBA   DBH
                           34    24177936      711115     3950160   **W F I
                           40    23652665      591316     2668917   **W F I
                            5       67613       13522       21214   SHMSG      QMG
                            4      110363       27590       60486   QBLKS      QMG

        PCB TOTAL
        ___ _____
                          131     2519092       19229
PSB TOTAL
___ _____                 305     6725063       20049

PROGDE1A TRMNALDA          20      624677       31233       68252   TRMNALDA   VBH
                            1      275811      275811      275811 PI TRMNALDA....

        PCB TOTAL
        ___ _____
                           21      900488       42880
         I/O PCB           16      488812       30550       79980   TRMNALDA   VBH
                            1       16118       16118       16118   SHMSG      QMG

        PCB TOTAL
        ___ _____
                           17      504930       29701
         TABLEDBA          16      290471       18154       33254   TABLEDA    DBH

        PCB TOTAL
        ___ _____
                           16      290471       18154

PSB TOTAL
___ _____                  54     1695889       31405

PROGHR2B HOTELDBB           8      698384       87298      184475   HOTELDBB   DBH
                            4     5820650     1455162     1455278 PI HOSINDXB....
                            4     4481024     1120256     1209075 PI HOTELDBB....
                            2      260817      130408      232750   HOSINDOB   VBH
                            7      106623       15231       16410   HOSINDXB   VBH
                            1       15366       15366       15366   HOTELDBD   DBH

        PCB TOTAL
        ___ _____
                           26    11382864      437802
PSB TOTAL
___ _____                  26    11382864      437802

PROGHR2A HOTELDBA          17      655801       38576      366108   HOSINDXA   VBH
                           73     1836721       25160       82141   HOTELDBA   DBH
                            2       54663       27331       41975   HOTELDBD   DBH
                            1        9887        9887        9887   HOTELDBC   DBH
                            2      851042      845635      845635   HOSINDOA   VBH

        PCB TOTAL
        ___ _____
                           95     3408114       35874
         I/O PCB           20      575847       28792       74227   HOTELDBA   DBH
                           21      370390       17637       43153   HOSINDXA   VBH
```

Figure 139. Program-I/O Report (Part 1 of 2)

```
     IMS MONITOR   ****PROGRAM I/O****               TRACE START 1993 022   14:00:18    TRACE STOP  1993 022  14:02:20  PAGE 0089
                                    .........IWAIT TIME.........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR2A I/O PCB            5     4654544      930908     2020043  **W F I
                            8    32796604     4099575     9328891  **W F I

        PCB TOTAL
        ___ _____          41      946237       23078
PSB TOTAL
___ _____                 136     4354351       32017

PROGPS2A LOGIMA            89     2046670       22996       73593   IMMSTR3A   VBH
                          612    53886417       88049      185674   IMMSTR1A   VBH
                            3       44906       14968       20788   IMINDEXA   VBH

        PCB TOTAL
        ___ _____         704    55977993       79514
                          469    11742900       25038      170337   COMPOSDA   DBH
                          329     8198418       24919       91422   CPINDEXA   VBH

        PCB TOTAL
        ___ _____         798    19941318       24989
         I/O PCB            3       47511       15837       20806   SHMSG      QMG

        PCB TOTAL
        ___ _____           3       47511       15837
PSB TOTAL
___ _____                1505    75966822       50476

PROGSC6C I/O PCB           52     2698602       51896      473763   INVENTRC   VBH
                            4       70921       17730       34241   SHMSG      QMG
                            3       50699       16899       24724   QBLKS      QMG

        PCB TOTAL
        ___ _____          59     2820222       47800
                           55     2666884       48488      210752   INVENTRC   VBH
                           50      797587       15951       41706   ININDEXC   VBH
                            1      119253      119253      119253 PI INVENTRC...1
                            1        8634        8634        8634   INVENTRB   VBH
                            2       83947       41973       53936   INVENTRA   VBH

        PCB TOTAL
        ___ _____         109     3676305       33727
PSB TOTAL
___ _____                 168     6496527       38669

PROGHR2D I/O PCB           21     2285296      108823      199223   HOTELDBD   DBH
                           28      762370       27227      111860   HOSINDXD   VBH
                            1       11685       11685       11685   SHMSG      QMG

        PCB TOTAL
        ___ _____          50     3059351       61187
         HOTELDBD          96     6279107       65407      139032   HOTELDBD   DBH

         MONITOR   ****PROGRAM I/O****               TRACE START 1993 022   14:00:18    TRACE STOP  1993 022  14:02:20  PAGE 0090
                                    .........IWAIT TIME.........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR2D HOTELDBD          31     2130585       68728      769130   HOSINDXD   VBH
                            3      115999       38666       56394   HOTELDBA   DBH
                            2       69833       34916       43470   HOTELDBC   DBH
                            2       41430       20715       28020   HOSINDOD   VBH
                            4     5515374     1378843     1458884 PI HOSINDXD....
                            4     3997017      999254     1026228 PI HOTELDBD....

PCB TOTAL
___ _____                 142    18149345      127812
PSB TOTAL
___ _____                 192    21208696      110461
```

Figure 139. Program-I/O Report (Part 2 of 2)

The I/O waits for the calls to the I/O PCB, are grouped as the first entries for a PSB. For DL/I calls, the data set for which the I/O took place is indicated under the DDN/FUNC heading, and the module code tells you what type of conflict caused the wait. For external subsystem calls, the function is indicated under the DDN/FUNC heading and the module code indicates the source of the call entry.

Names other than LGMSG and SHMSG can appear in the DDN/FUNC column for I/O PCBs. An example is a checkpoint call issued by an application program (using an I/O PCB) which causes a database buffer to be written.

If the program is designated as wait-for-input and has to wait for the input of the next message, the wait entry is marked **WFI under the DDN/FUNC heading and no entry appears in the MODULE column. The time spent waiting for the next input message is shown under wait time. **WFI entries are shown for information only and their values are not used to compute statistics.

Contention for the same physical segment in a database causes a wait on behalf of program isolation. This is shown in the DDN/FUNC column, on the PCB line, by the entry PIdmb, where dmb is the DMB of the physical data set. The MODULE column identifies the segment type using the physical segment code assigned by DBD generation.

When an application is accessing a database using VSAM as the access method, DL/I calls do not generally result in an I/O wait. A MODULE column entry of VBH indicates that interface to VSAM occurred and there was an I/O wait.

A seemingly unrelated entry can occur under the DDN/FUNC column for a database PCB. An example is a retrieval call to a database (DB-A) that causes a buffer to be purged in order to make room for that retrieved data. If the buffer contents included data belonging to another database (DB-B), the I/O entry in the report shows the ddname for DB-B as being in conflict for PCB access to DB-A.

Monitoring MFS Activity

You can obtain a summary of all activity that occurs for management of message format buffer pool use from the Message Format Buffer Pool report. The report is illustrated in Figure 140 on page 401. The data shows the counts at the start and end of the trace interval and their difference.

When message formatting occurs, the appropriate message blocks must reside in the message format buffer pool, a DIF/MID pair for input or a DOF/MOD pair for output. If the blocks are not already in the buffer, I/O to the active IMS.FORMATA/B library must occur. Block retrieval can involve a prior directory lookup, or be direct, using an index kept in the pool.

Many of the counts reveal details of internal event management. When there is no directory entry for a block this implies extra directory lookup I/O.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0007

                M E S S A G E   F O R M A T   B U F F E R   P O O L

                                                                    5:55:15          5:59:49
                                                                  START TRACE      END   TRACE       DIFFERENCE

    NUMBER OF P/F REQUESTS                                                  0               0                0
    NUMBER OF I/F REQUESTS                                                 18              20                2
    NUMBER OF I/F I/O'S                                                     2               2                0
    NUMBER OF TIMES POOL COMPRESS WOULD BE SUCCESSFUL                       0               0                0
    NUMBER OF DIRECTORY I/O OPERATIONS                                      2               2                0
    NUMBER OF TIMES BLOCK WASHED FOR FRE                                    0               0                0
    NUMBER OF TIMES P/F REQUEST IGNORED                                     0               0                0
    NUMBER OF F/B REQUESTS                                                 18              20                2
    NUMBER OF TIMES F/B REQUEST IGNORED                                     0               0                0
    NUMBER OF TIMES I/F ON F/B QUEUE                                       16              18                2
    NUMBER OF TIMES I/F ON I/F QUEUE                                        0               0                0
    NUMBER OF TIMES F/B ON I/F QUEUE                                       18              20                2
    NUMBER OF TIMES P/F ON I/F QUEUE                                        0               0                0
    NUMBER OF TIMES P/F ON F/B QUEUE                                        0               0                0
    NUMBER OF TIMES THERE WAS NO DIR ENTR FOR A BLOCK                       0               0                0
    NUMBER OF TIMES I/O ERRORS POINT OR READ MACRO                          0               0                0
    NUMBER OF IMMEDIATE I/O REQUESTS WAITED DUE TO MAXIMUM I/O              0               0                0
    NUMBER OF REQUESTS SATISFIED BY INDEX/DYNAMIC DIRECTORY                 0               0                0

    QUOTIENT :  IMMEDIATE FETCH I/O'S + DIRECTORY I/O'S OPERATIONS =    0.00
                ____________________________________________________________________________________
                                    TOTAL NUMBER OF TRANSACTIONS
```

Figure 140. Message Format Buffer Pool Report

Monitoring Message Queue Handling

A key resource that directly affects the efficiency of transaction processing is the message queue pool and the management of the I/O to the message queues. You can examine the activity by looking at the Message Queue Pool report. Figure 141 illustrates the report. Counts of activities are given at start and end of the trace interval and as the differences between start and end numbers.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0002

                M E S S A G E   Q U E U E   P O O L

                                                                    5:55:15          5:59:49
                                                                  START TRACE      END   TRACE       DIFFERENCE

    NUMBER OF LOCATE CALLS FROM QMGR                                    54204           68436            14232
    NUMBER OF RECORD RELEASE CALLS FROM QMGR                            16431           20738             4307
    NUMBER OF LOCATE AND ALTER CALLS FROM QMGR                         131593          164744            33151
    NUMBER OF REQUESTS TO PURGE THE Q POOL                                  2               2                0
    NUMBER OF ADDRESS TO DRRN TRANSLATION REQUESTS                      21351           27076             5725
    NUMBER OF REQUESTS TO WAIT FROM QMGR                                    0               0                0
    NUMBER OF READ REQUESTS                                               962             962                0
    NUMBER OF WRITE REQUESTS(TOTAL)                                       499             499                0
    NUMBER OF WRITES DONE BY PURGE                                        499             499                0
    NUMBER OF WAITS FOR PURGE COMPLETION                                    1               1                0
    NUMBER OF WAITS BECAUSE NO BUFFER AVAILABLE                             0               0                0
    NUMBER OF WAITS FOR OTHER DECB TO READ THIS BUFFER                    823             823                0
    NUMBER OF WAITS FOR OTHER DECB TO WRITE THIS BUFFER                     0               0                0
    NUMBER OF WAITS FOR CONFLICTING END DEQ BUFFER REQ                      0               0                0
    NUMBER OF PSBS UNCHAINED FROM BUFFERS                                   0               0                0
    NUMBER OF CALLS TO QMGR.(TOTAL)                                     48164           62213            14049
    NUMBER OF CALLS TO REPOSITION A LOST BUFFER                             0               0                0
    NUMBER OF CALLS TO ENQ A MESSAGE                                    10583           13441             2858
    NUMBER OF CALLS TO DEQ ONE OR MORE MESSAGE                           6321            7767             1446
    NUMBER OF CALLS TO CANCEL INPUT OR OUTPUT                             119             121                2

    QUOTIENT :  TOTAL NUMBER OF OSAM READS + OSAM WRITES + ALL IWAITS =     0.00
                ____________________________________________________
                            TOTAL NUMBER OF TRANSACTIONS
```

Figure 141. Message-Queue-Pool Report

Detecting Checkpoint Effects

When a checkpoint command specifies SNAPQ, the current status of all message queues is written to the system log. This prevents any message handling on behalf of queue management. The `General Iwait Time Events` records the wait time incurred by the SNAPQ. Figure 142 shows the activity on the summary line `QMGR SNAPQ CHECK`. The number of occurrences is given with the total, average, and maximum wait times.

```
       IMS MONITOR   ** GENERAL REPORTS **            TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0009
                GENERAL IWAIT TIME EVENTS
    EVENT                              ..........IWAIT TIME...........    DISTRIBUTION
    IWAITS          OCCURRENCES        TOTAL         MEAN      MAXIMUM       NUMBER
    ______          ___________        _____         ____      _______       ______
QMGR SNAPQ CHECK              0            0            0            0            0
                REGION AND JOBNAME REPORT
REG. NO.   JOB NAME
________   ________
     1     MPR1A100
     2     MPR1A209
     3     MPR1A210
     4     MPR1A211
     5     MPR1A103
     6     MPR1A101
     7     MPR1A115
     8     MPR1A116
     9     MPR1A216
    10     MPR1A200
    11     MPR1A217
    12     MPR1A119
    13     MPR1A218
    14     MPR1A219
    15     MPR1A104
    16     MPR1A220
    17     MPR1A203
    18     MPR1A123
    19     MPR1A222
    20     MPR1A105
    21     MPR1A124
    22     MPR1A223
    23     MPR1A107
    24     MPR1A224
    25     MPR1A106
    26     MPR1A206
    27     MPR1A205
    28     MPR1A108
    29     MPR1A109
    30     MPR1A208
    31     MPR1A111
    32     MPR1A112
    33     MPR1A113
    34     MPR1A204
    35     MPR1A114
    36     MPR1A102
    48     MPR1A121
    49     MPR1A122
    50     MPR1A221
```

Figure 142. General Reports for SNAPQ Effects

Transaction Queueing Report

In addition to monitoring the efficiency of message handling, you can monitor the service provided for each application, by looking at the size of the transaction queues at each scheduling of their processing programs.

The Transaction-Queuing report shown in Figure 143 on page 403 records, for each transaction, the minimum, average, and maximum counts at scheduling time. The total number of dequeued transactions (or transactions that have been fully processed) during the monitored interval is given for each transaction code. The average number of transactions processed for each scheduling is given in the `DEQUEUED MEAN` column.

```
     IMS MONITOR   ****TRANSACTION QUEUING****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0181
                                                                (B)                              (A)
                   NUMBER      NUMBER      ..ON QUEUE WHEN SCHEDULED.....    DEQUED      DISTRIBUTION
TRANSACTION        DEQUED      SCHEDS.     MINIMUM    MEAN        MAXIMUM    MEAN        NUMBER
___________        ______      ______      _______    ____        _______    ____        ______

 SC6X                13          1           0       0.00           0      13.00         883A,B
 IT8W                17          3           0       0.00           0       5.66         887A,B
 TS1Z                16          1           0       0.00           0      16.00         891A,B
 PS3X                23          1           0       0.00           0      23.00         895A,B
 PS3Y                17          7           0       0.00           0       2.42         899A,B
 IT1V                11          6           0       0.00           0       1.83         903A,B
 SC2Z               143          2           0       0.00           0      71.50         907A,B
 IT8U                12          7           0       0.00           0       1.71         911A,B
 PS2W                10          1           0       0.00           0      10.00         915A,B
 TS1U                12          4           0       0.00           0       3.00         919A,B
 PS3W                14          1           0       0.00           0      14.00         923A,B
 IT8Y                16          5           0       0.00           0       3.20         927A,B
 IT1W                 9          1           0       0.00           0       9.00         929A,B
 SC2W                 9          1           0       0.00           0       9.00         933A,B
 IT2V                13          5           0       0.00           0       2.60         937A,B
 IT2W                17          6           0       0.00           0       2.83         941A,B
 TS1V                 9          1           0       0.00           0       9.00         945A,B
 SC2V                12          5           0       0.00           0       2.40         947A,B
 TS1W                11          1           0       0.00           0      11.00         949A,B
 PS3V                13          3           0       0.00           0       4.33         953A,B
 IT1U                 9          6           0       0.00           0       1.50         957A,B
 SC4U                11          5           0       0.00           0       2.20         962A,B
 SC6W                10          1           0       0.00           0      10.00         966A,B
 PS2V                 8          6           0       0.00           0       1.33         970A,B
 IT8X                12          1           0       0.00           0      12.00         974A,B
 SC4W                10          1           0       0.00           0      10.00         978A,B
 SC6U                14          6           0       0.00           0       2.33         982A,B
 IT2Y                 9          3           0       0.00           0       3.00         986A,B
 SC2X                15          1           0       0.00           0      15.00         990A,B
 PS2Y                17          2           0       0.00           0       8.50         994A,B
 SC4Y               152          4           0       0.50           1      38.00         998A,B
 SC2Y               106          2           0       0.00           0      53.00        1000A,B
 IT2X                20          1           0       0.00           0      20.00        1004A,B
 SC2U                15          3           0       0.00           0       5.00        1008A,B
 SC4Z               123          5           0       0.60           1      24.60        1010A,B
 TS1X                15          1           0       0.00           0      15.00        1015A,B
 SC4X                19          1           0       0.00           0      19.00        1019A,B
 PS2X                13          1           0       0.00           0      13.00        1024A,B
 PS2Z                20          5           0       0.00           0       4.00        1028A,B
 SC6Z               130          1           0       0.00           0     130.00        1031A,B
 SC6V                10          4           0       0.00           0       2.50        1035A,B
 SC6Y               143          1           0       0.00           0     143.00        1037A,B
 IT1X                10          1           0       0.00           0      10.00        1040A,B
 PS3U                19          6           0       0.00           0       3.16        1131A,B
 IT2U                13          4           0       0.00           0       3.25        1146A,B
```

Figure 143. Transaction-Queuing Report

Monitoring Database Buffers

One of the key resources in an online system is the database buffer pool. The efficiency of DL/I call service depends on the presence of the required database logical record in the buffer, so that segment retrieval does not require additional I/O. This is especially true for “hold” calls with intervening database calls prior to a replace call. You can assess the general efficiency of the pool management using the Database-Buffer-Pool report shown in Figure 144 on page 404. The event counts on this report are not specific to a particular database or program but represent the pressure for use of the database pool.

Related Reading: For more information about the Database Buffer Pool reports, see *IMS Version 9: Utilities Reference: Database and Transaction Manager*.

If any of your databases use VSAM as the access method, the IMS Monitor produces a series of reports headed `VSAM BUFFER POOL`, one for each subpool. Figure 145 on page 404 shows one of these reports.

```
                D A T A   B A S E   B U F F E R   P O O L

                                                        FIX PREFIX/BUFFERS              Y/Y
                                                        SUBPOOL ID                     004K
                                                        SUBPOOL BUFFER SIZE            4096
                                                        TOTAL BUFFERS IN SUBPOOL       1000

                                                    17:08:15        17:10:16

    NUMBER OF LOCATE-TYPE CALLS                      1117674         1676213          558539
    NUMBER OF REQUESTS TO CREATE NEW BLOCKS                0               0               0
    NUMBER OF BUFFER ALTER CALLS                      215874          322936          107062
    NUMBER OF PURGE CALLS                              25077           37454           12377
    NUMBER OF LOCATE-TYPE CALLS, DATA ALREADY IN OSAM POOL   870306    1301187          430881
    NUMBER OF BUFFERS SEARCHED BY ALL LOCATE-TYPE CALLS   1258247    1886843          628596
    NUMBER OF READ I/O REQUESTS                        238165          360260          122095
    NUMBER OF SINGLE BLOCK WRITES BY BUFFER STEAL ROUTINE          0       0               0
    NUMBER OF BLOCKS WRITTEN BY PURGE                   95057          142413           47356
    NUMBER OF LOCATE CALLS WAITED DUE TO BUSY ID          780            1297             517
    NUMBER OF LOCATE CALLS WAITED DUE TO BUFFER BUSY WRT           0       0               0
    NUMBER OF LOCATE CALLS WAITED DUE TO BUFFER BUSY READ          0       0               0
    NUMBER OF BUFFER STEAL/PURGE WAITED FOR OWNERSHIP RLSE   178             261             83
    NUMBER OF BUFFER STEAL REQUESTS WAITED FOR BUFFERS             0       0               0
    TOTAL NUMBER OF I/O ERRORS FOR THIS SUBPOOL                    0       0               0
    NUMBER OF BUFFERS LOCKED DUE TO WRITE ERRORS                   0       0               0

    QUOTIENT :  TOTAL NUMBER OF OSAM READS + OSAM WRITES =      6.98
                ____________________________________________
                        TOTAL NUMBER OF TRANSACTIONS
```

Figure 144. Database-Buffer-Pool Report

```
***I M S   M O N I T O R***  BUFFER POOL STATISTICS

                V S A M   B U F F E R   P O O L

                                                        FIX INDEX/BLOCK/DATA          N/Y/N
                                                        SHARED RESOURCE POOL ID       VPL1
                                                        SHARED RESOURCE POOL TYPE        D
                                                        SUBPOOL ID                       2
                                                        SUBPOOL BUFFER SIZE           4096
                                                        NUMBER HIPERSPACE BUFFERS       50
                                                        TOTAL BUFFERS IN SUBPOOL      1000

                                                    17:08:15        17:10:16

    NUMBER OF RETRIEVE BY RBA CALLS RECEIVED BY BUF HNDLR   152             330             178
    NUMBER OF RETRIEVE BY KEY CALLS                  117780          178424           60644
    NUMBER OF LOGICAL RECORDS INSERTED INTO ESDS        132             310             178
    NUMBER OF LOGICAL RECORDS INSERTED INTO KSDS       6460            9853            3393
    NUMBER OF LOGICAL RECORDS ALTERED IN THIS SUBPOOL      0               0               0
    NUMBER OF TIMES BACKGROUND WRITE FUNCTION INVOKED      0               0               0
    NUMBER OF SYNCHRONIZATION CALLS RECEIVED         18566           27923            9357
    NUMBER OF WRITE ERROR BUFFERS CURRENTLY IN THE SUBPOOL      0          0               0
    LARGEST NUMBER OF WRITE ERRORS IN THE SUBPOOL          0               0               0
    NUMBER OF VSAM GET CALLS ISSUED                  124648          189220           64572
    NUMBER OF VSAM SCHBFR CALLS ISSUED                     0               0               0
    NUMBER OF TIMES CTRL INTERVAL REQUESTED ALREADY IN POOL   33662        51088           17426
    NUMBER OF CRTL INTERVALS READ FROM EXTERNAL STORAGE   91169          138505           47336
    NUMBER OF VSAM WRITES INITIATED BY IMS            6022            9251            3229
    NUMBER OF VSAM WRITES TO MAKE SPACE IN THE POOL        0               0               0
    NUMBER OF VSAM READS FROM HIPERSPACE BUFFERS           0               0               0
    NUMBER OF VSAM WRITES FROM HIPERSPACE BUFFERS         50              50               0
    NUMBER OF FAILED VSAM READS FROM HIPERSPACE BUFFERS    0               0               0
    NUMBER OF FAILED VSAM WRITES FROM HIPERSPACE BUFFERS   0               0               0

    QUOTIENT :  TOTAL NUMBER OF VSAM READS + VSAM WRITES =      2.08
                ____________________________________________
                        TOTAL NUMBER OF TRANSACTIONS
```

Figure 145. VSAM-Buffer-Pool Report

Monitoring Line Activity

You can obtain a summary of all occurrences of activity for each BTAM line or VTAM node that handles message traffic during the monitored interval. The elapsed times and not-wait times are given in categories of total, mean, and maximum times for each communication line in the Communication-Summary report. Figure 146 illustrates this report.

You must match which physical devices are using the line to the Stage 1 output from system definition. The line numbers are assigned sequentially, according to their physical occurrence in the Stage 1 input deck.

If your online system specifies the prefetch option for MFS blocks in the control region JCL, the last line of the report contains the statistics for all prefetch events.

You can also investigate the amount of data transmitted across BTAM lines or for VTAM nodes with the Line-Functions report. Figure 147 illustrates this report. The report distinguishes between input data and output data. The number of blocks of data and the average and maximum size of the blocks are recorded for data received by IMS and for transmitted data.

This report also includes a measure of how inactive the lines are. An inactive interval is assumed to be the difference between the time that marks the end of the last input block received and the starting time for output transmission. These occurrences of inactivity are termed turnaround intervals, and the report cumulates the number of occurrences as well as the average and maximum times associated with these intervals.

If the line is being used by an MFS-supported terminal, a count of the number of requests for next page for a multipage message is recorded.

If link traffic for coupled multiple systems is recorded, a set of three reports follows the Line Functions report. These are described in “Interpreting IMS Monitor MSC Reports” on page 414.

```
   IMS MONITOR   ****COMMUNICATION SUMMARY****       TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0089
                                                (A)                                (B)
    NODE OR                                .........ELAPSED TIME.........       NOT IWAIT TIME(ELAPSED-IWAIT)    DISTRIBUTION
  LINE NUMBER       OCCURRENCES       TOTAL        MEAN     MAXIMUM       TOTAL        MEAN     MAXIMUM      NUMBER
  ___ _____         ___________       _____        ____     _______       _____        ____     _______      ______
    PMT01A                    3        2396         798        1547        2396         798        1547       1467A,B
        19                  182       92155         506        1106       92155         506        1106       1493A,B
         2                   59        2280          38          41        2280          38          41       1515A,B
     TOTAL
     _____                  244       96831         396                   96831         396
```

Figure 146. Communication-Summary Report

```
   IMS MONITOR   ****LINE FUNCTIONS***              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0091
                              (A).....................(B)..............                  .....................
                                MEAN     MAX.            MEAN    MAX.     .        TURN        .                  .
  NODE OR   DEVICE  RECEIVE RECEIVE RECEIVE   TRANS.  TRANS.  TRANS.  DIST.      AROUND      MEAN         MAX.   DIST.   PAGING
LINE NUMBER  TYPE    BLOCKS BLKSIZE BLKSIZE   BLOCKS BLKSIZE BLKSIZE NUMBER    INTERVALS   INTERVAL    INTERVAL  NUMB.  REQUESTS
___ _____ _____   ______ _______ _______   ______ _______ _______ _____ _____   _________   ________    ________  _____  ________
  PMT01A    3270V        1      29      29        2     170     171   1468A,B           3        798        1547   1466         0
       19   XXXX                                                                     182        506        1106   1492         0
        2   LOC SYS                                                                   59         38          41   1514         0
ALL LINES
___ _____                1      29               2     170                         244        396                         0
```

Figure 147. Line-Functions Report

Monitoring Message Handling Efficiency

The IMS Monitor produces both summary and detailed information on asynchronous processing that takes place in the IMS control region. Asynchronous processing occurs when data transmitted from BTAM terminals or from VTAM arrives. Application program responses also result in asynchronous processing.

The space in four major buffer pools and access to format, SPA, and message queue data sets are managed for the total communications traffic. Wait times are recorded when contention for pool space or I/O interrupts the processing of any of the communication tasks triggered by line activity. This information is contained in the Communication Wait report, shown in Figure 148.

This report is similar to the Communication-Summary report because the line number identifies the series of communication processing tasks.

```
     IMS MONITOR   ****COMMUNICATION IWAIT*****        TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0090
  NODE OR                      .........IWAIT TIME..........                                                    DIST.
LINE NUMBER  OCCURRENCES       TOTAL        MEAN     MAXIMUM     FUNCTION           BLKSIZE  MODULE       NO.
____ ______ __________       _____        ____     _______     ________           _______  ______      ____
ALL LINES...
PREFETCH I/O
________ ___        NONE
```

Figure 148. Communication-Wait Report

IMS Internal Resource Usage

There are several summary reports that you can use to examine the level of internal contention for resources. The following sections give a brief explanation of these reports.

Pool Space Failure

The Pool Space Failure Summary report gives the number of times in each region a given amount of storage was unavailable. It shows the number of bytes, the identification of the pool, and the number of occurrences when storage was unavailable. You can use this summary to determine if you need to increase the buffer pool allocation, either by a system definition change or by overriding the number of buffers in the EXEC statements in the JCL.

The format of the report is shown in Figure 149.

```
POOL SPACE FAILURE SUMMARY

          POOL ID    BYTES REQ.    OCCURRENCES
          DLMP           8888            1
          DLDP           7777            1
     TOTAL                                 2
```

Figure 149. Pool-Space-Failure Report

Programs Experiencing Deadlock

Each time a pair of programs reaches a deadlock over ownership of a segment in a given database data set, the Deadlock-Event-Summary report records the occurrence. Each line in the report shows the two PSBs involved and indicates which is given processing right-of-way (REQ-ING PSB) and which has to reprocess

after dynamic backout occurs (LOSING PSB). The report is illustrated in Figure 150.

```
DEADLOCK EVENT SUMMARY

     REQ-ING PSB    LOSING PSB    DMBNAME    OCCURRENCES
     PSBNAME1       TPPSBRE3      DBASEBAL       1
  TOTAL                                          1
```

Figure 150. Deadlock-Event-Summary Report

IMS Latch Conflict

The basic serialization of the task processing in IMS is controlled by ownership of an IMS latch. When different programs are executing, they compete for the ownership. If they wait for the resource, the one possessing the latch has to post the other ITASK waiting for it. Use the Latch Conflict Statistics report to judge the level of contention for a resource.

The different types of latches and the counters that exhibit the level of contention are given in the Latch Conflict Statistics report. Figure 151 on page 409 is an example of this report. The entries are organized according to the latch names.

The latch names, which are abbreviations for the different types of resources being serialized, are as follows:

Abbreviation	Latch Name
'DISP'	SYS/DISPATCHER
'DCSL'	DC/CHECKPOINT DC SYSTEM
'LUML'	DC/LU 6.2 LUM
'CONV'	DC/CONVERSATION CHECKPT
'TERM'	DC/TERMINAL
'LUBT'	DC/LU62 LUB-TIB CHAIN
'SCHD'	TM/SCHEDULING
'TCTB'	TM/TCT BLOCK
'APSB'	TM/ALLOCATE PSB (BLK MVR)
'PDRB'	TM/PDIR BLOCK (BLK MVR)
'PSBP'	TM/PSB POOL (BLK MVR)
'DMBP'	TM/DMB POOL (BLK MVR)
'PSBB'	TM/PSB BLOCK (BLK MVR)
'DMBB'	TM/DMB BLOCK (BLK MVR)
'PDRP'	TM/PDIR POOL (BLK MVR)
'DBAU'	TM/DBRC AUTH (BLK MVR)
'DDRB'	TM/DDIR BLOCK (BLK MVR)
'DDRP'	TM/DDIR POOL (BLK MVR)
'DBBP'	DB/OSAM BUFFER POOL
'DBLR'	DB/DFSDBLR0 MODULE

'SUBQ'	TM/TM SUBQUEUES
'DBSL'	DB/DB CHECKPOINT
'USER'	DC/USER
'DBLT'	RSR SHARING SERIALIZE
'CCTL'	SYS/DBCTL RESOURCE
'VTCB'	SYS/CBTS VTCB POOL
'VLQB'	SYS/CBTS LQB POOL
'CBTS'	SYS/CBTS POOLS (ALL)
'BLKM'	TM/SMB QUEUE HASH TABLE
'QMGR'	SYS/QUEUE MANAGER
'QBSL'	SYS/QUEUE BUFFER
'SMGT'	SYS/STORAGE MANAGEMENT
'DBLK'	SYS/DEPENDENT REGION
'XCNQ'	DB/EXCLUSIVE ENQ/DEQ
'ACTL'	SYS/STATISTICS
'LOGL'	SYS/LOGGER

When a system checkpoint is taken during the time the monitor is active, latch conflict statistics are reset to zero, thus corrupting the values presented in this report. If this situation exists, the following message will be inserted at the top of the report:

```
**** A CHECKPOINT OCCURRED DURING MONITOR RUN ****
****  LATCH CONFLICT STATISTICS ARE INVALID   ****
****      SEE UTILITIES REFERENCE MANUAL      ****
```

However, if the master terminal operator issues the `/CHECKPOINT` command with the `STATISTICS` keyword parameter, latch conflict statistics are reset to zero, but the IMS monitor is not notified. Therefore, DFSUTR20 cannot detect that the statistics have been corrupted and does not issue this message.

Recommendation: Do not issue statistics checkpoints while the monitor is running.

```
        IMS MONITOR   ** GENERAL REPORTS **          TRACE START 1993 209...

                LATCH CONFLICT STATISTICS

LATCH       COUNT                 AT          AT
NAMES       FIELD           START         END        DIFF.

LOGL     CONTENTIONS              0           0           0

SMGT     CONTENTIONS              0           0           0

XCNQ     CONTENTIONS              0           0           0

ACTL     CONTENTIONS              0           0           0

CBTS     CONTENTIONS              0           0           0

DBLK     CONTENTIONS              0           0           0
```

Figure 151. Latch-Conflict-Statistics Report

Using Frequency Distributions from IMS Monitor Output

The reports derived from the IMS Monitor data records contain many summary lines where the mean time is given. If you are interested in the distribution of those timed events, rather than just average and maximum times, you can request the Report Print utility to individually record the events in a frequency distribution across a range of intervals. Some distributions are not time dependent, such as those for transaction queue loads or transmitted block sizes.

How to Get a Frequency Distribution Output

To request the IMS Monitor Report Print utility to gather distribution data, you must include a `DIS` input control statement. This causes all report items with an entry under a column headed `MEAN` to have a corresponding frequency distribution as part of the Distribution Appendix. Each report line includes an identifying reference number under the column headed `Distribution Number` so that you can locate the distribution data in the appendix, flagged by that same number.

The following tables show the major IMS Monitor reports and the type of frequency distributions generated for each report. Each type results in several distributions, depending on how many entries are in each section of the report. For each type of frequency distribution, the data is cumulated in suitable intervals or ranges. The set of ranges used for each type is given an identifier, shown in the ID column. Table 29 shows the report distributions sorted by Region Summary.

Table 29. Distribution Reports by Region Summary

Report Name	ID	Description
Schedule end to 1st DL/I call	D1	Elapsed time
Elapsed execution time	D2	Not wait time
DL/I calls	D3	N/A
	D4	N/A
External Subsystem calls	D5	Elapsed time
Waits per DL/I call	D6	Not wait time
Idle for intent	D43	Elapsed time

Table 29. Distribution Reports by Region Summary (continued)

Report Name	ID	Description
Checkpoint	D7	N/A
	D8	N/A
	D20	Elapsed time
	D21	Not wait time

Table 30 shows the report distributions sorted by Program Region.

Table 30. Report Distributions by Program Region

Report Name	ID	Description
Elapsed execution time	D30	N/A
Schedule end to 1st DL/I call	D31	N/A

Table 31 shows the report distributions sorted by Program Summary.

Table 31. Report Distributions by Program Summary

Report Name	ID	Description
Processor time per schedule	D15	N/A
Transactions dequeued per schedule	D14	N/A
Elapsed time per schedule	D9	N/A
Schedule end to 1st DL/I call	D10	N/A

Table 32 shows the report distributions sorted by Communication Summary.

Table 32. Report Distributions by Communication Summary

Report Name	ID	Description
Line elapsed time	D18	N/A
Line not wait time	D19	N/A

Table 33 shows the report distributions sorted by Line Functions.

Table 33. Report Distributions by Line Functions

Report Name	ID	Description
Received block length	D36	N/A
Transmitted block length	D37	N/A
Inactive intervals	D38	N/A

Table 34 shows the report distributions sorted by MSC Queuing Summary.

Table 34. Report Distributions by MSC Queuing Summary

Report Name	ID	Description
Time in queue	D39	N/A

Table 35 shows the report distributions sorted by Transaction Queuing.

Table 35. Report Distributions by Transaction Queuing

Report Name	ID	Description
Transactions on queue at schedule	D17	N/A
Transactions dequeued per schedule	D16	N/A
Prefetch format blocks	D28	Elapsed time
	D29	Not wait time

Table 36 shows the report distributions sorted by Call Summary.

Table 36. Report Distributions by Call Summary

Report Name	ID	Description
PSB waits per DL/I call	D13	N/A
PSB waits per external subsystem call	D44	N/A
PSB elapsed time per call	D11	N/A
PSB not wait time per call	D12	N/A
PSB external subsystem calls	D45	Elapsed time

Table 37 shows some distributions derived from buffer pool statistics for wait times.

Table 37. Wait Time Distributions

Function	ID	Module Key
Storage	D22	SMN
OSAM I/O	D23	DBH
VSAM I/O	D24	VBH
Scheduler internal	D25	MSC
Queue manager I/O	D26	QMG
Block loader I/O	D27	BLR
MFS block I/O	D32	MFS
MFS directory I/O	D33	MFS
HSAM I/O	D34	DIE
Format Buffer Pool Space	D35	PMM
PI enqueue	D40	None
QMGR SNAPQ Check	D42	None

How Frequency Distribution Ranges Are Defined

A set of ten intervals is defined for each summary line and the occurrences falling in each interval are cumulated. The interval ranges are preset with default end points. For example, the end points, for DL/I call elapsed time are: 0, 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, INF (all times are in milliseconds). The default end points are chosen so that they are suitable to the event. The lower limit of the first interval always defaults to zero, and the upper limit of the tenth interval is infinity (INF).

Although several types of distribution can use the same set of end points, each type is assigned a distribution identifier. You can use this to redefine the end points. To override the default end points, include an input control statement to the Report Print utility. The statement specifies the type of distribution identifier and gives the desired end point values. For example, the DL/I call elapsed time end points could be respecified by:

```
D5   0,500,1000,1500,2000,4000,,,100000,500000
```

The values of the unspecified end points remain at their default values of 32000 and 64000 as does the last (INF).

Figure 152, which is a sample page taken from a Distribution Appendix, shows how individual distributions are numbered, and how ranges vary with the type of distribution. The lines are arranged in pairs, with the second one recording the cumulated counts.

```
     IMS MONITOR   ****DISTRIBUTION APPENDIX****       TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0200

#    1...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    2...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    3...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    4...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    5...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          6
#    6...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          8
#    7...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    8...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          9
#    9...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   10...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  1          0          0          0          0          0          0          0          0          7
#   11...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   12...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          8
#   13...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   14...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   15...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  1          0          0          0          0          0          0          0          0          8
#   16...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
```

Figure 152. Distribution-Appendix Report

Default Values of Distribution Definitions

Using an identifier provided in the frequency distribution tables (Table 29 on page 409 through Table 36 on page 411) and the Wait Time Distributions table (Table 37 on page 411) you can determine the default end points for the distribution by locating it in the following list:

D1, D2, D5, D6, D9, D10, D11, D12, D15 D18, D19, D20, D21, D22, D25, D27 D28, D29, D30, D31, D43, and D45
0, 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, INF

D3 0, 50000, 100000, 150000, 200000, 250000, 300000, 350000, 400000, 450000, INF

D4 0, 200000, 400000, 600000, 800000, 1000000, 1200000, 1400000, 1600000, 1800000, INF

D7, D13, and D44
0, 0, 1, 2, 3, 4, 5, 6, 7, 8, INF

D8 0, 100000, 200000, 300000, 400000, 500000, 600000, 700000, 800000, 900000, INF

D14, D16, D17
0, 1, 2, 3, 4, 5, 10, 15, 30, 90, INF

D23, D24, D26, D32, D40, D42
0, 2000, 8000, 24000, 50000, 100000, 150000, 200000, 250000, 300000, INF

D33, D34, D35
0, 2000, 4000, 8000, 16000, 32000, 64000, 96000, 128000, 160000, INF

D36, D37 0, 10, 20, 40, 80, 100, 200, 400, 800, 1000, INF

D38 0, 1000, 10000, 100000, 200000, 500000, 800000, 1000000, 1500000, 2000000, INF

D39 0, 1000, 5000, 10000, 50000, 100000, 500000, 1000000, 5000000, 10000000, INF

Interpreting Distribution Appendix

You can use the detailed output in the Distribution Appendix when you suspect an unusual combination of events was reported in a report summary line. Usually, the average and maximum times or counts are sufficient to highlight a resource usage problem. However, if you suspect the mean value to be masking an unusual distribution you can draw on the detail contained in the IMS Monitor output records.

For example, suppose you are investigating a change in the scheduling algorithm for a particular transaction and need to know how many transactions were able to be processed for each scheduling of an application program. Figure 153 shows a possible histogram for the processed transactions:

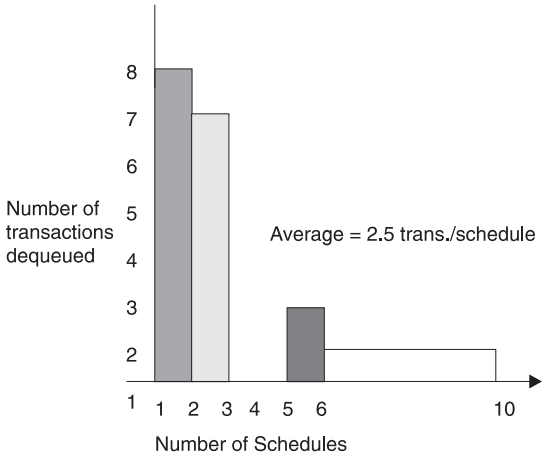


Figure 153. Number of Transactions Processed For Each Scheduling Of An Application Program

The Average=2.5 transactions pre schedule. The distribution in Figure 153 suggests that many schedules were able to process only one or two transactions, and few schedules significantly exhausted the queue. The distribution data for the histogram is as follows:

Frequency Distribution

```
Number of schedules    1    2    3    4    5    6-10    >10

Transactions dequeued  8    7    0    0    2    1       0
```

The Distribution Appendix presents the histogram data in the form of two lines:

- The first line shows the intervals, prefixed by a cross reference to an individual line on the earlier output.
- The second line gives the number of events occurring in those intervals.

This data appears as follows:

```
# 950B...0...1...2...3...4...5...10...15...30...90...INF
           8   7   0   0   2   1    0    0    0    0
```

The cross reference `950B` points to a unique report line. For example, the Transaction-Queuing report on the appropriate line for the transaction of interest show, `950A,B` under the column headed `DISTRIBUTION NUMBER`. Use the reference number 950B to locate the data in the Distribution Appendix. The 950A reference points to the data for the number of transactions in the queue at schedule time.

Interpreting IMS Monitor MSC Reports

The IMS Monitor Report Print program includes three reports that highlight message events caused by system coupling.

- MSC-Traffic report

  This report shows the enqueue and dequeue counts of messages that use the various link paths for the monitor interval.
- MSC-Summary report

  This report shows summaries of:
  - The traffic queues for each input transaction name
  - The traffic queues for each destination name
  - The traffic queues for each link number
  - The traffic queues for each destination system
- MSC-Queuing-Summary report

  This report is generated only when intersystem messages are queued on the local system before being sent to the destination system. The local system must be an intermediate system. This report shows:
  - Maximum time messages spend in queues
  - Average time messages spend in queues
  - Maximum queue lengths
  - Maximum queue counts
  - Total number of messages queued for all links the local system participates in

All three of the reports can have entries in the Distribution Appendix. You can examine the frequency distributions of the traffic if you suspect unusual transmission patterns.

Determining Cross-System Queuing

The MSC-Traffic report reveals the individual queue loads for all traffic between partner systems of which the monitored system is the local system. The report lists all the unique system identification numbers (SIDs) that are defined for communications for that local system. It then summarizes the total messages queued and dequeued for each combination of the following variables:

- Input name (terminal or program that was a message source)
- Destination name (terminal or program)
- Input system (SID)
- Destination system (SID)
- Link number
- Link type (BSYN, MTM, CTC, or VTAM)

Figure 154 illustrates this report. If a message originates in the local system, its presence is accounted for in the dequeue counts only. Messages with local destinations appear only in the enqueue count.

```
     IMS MONITOR   ****MSC TRAFFIC REPORT****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0151
LOCAL SID VALUES = 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115
 INPUT     DESTIN.   INPUT  DEST.  LINK  LINK  ENQUEUE  DEQUEUE
  NAME      NAME      SID    SID    NO.  TYPE    COUNT    COUNT

DSWT3685  DSWT3685      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT6161  DSWT6161      3      3     3    C-C        0        1
          SC6Z          3    103     3    C-C        1        0
DSWT3838  DSWT3838      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT4618  DSWT4618      3      3     3    C-C        0        1
          SC6Z          3    103     3    C-C        1        0
DSWT3903  DSWT3903      3      3     3    C-C        0        1
          SC2Z          3    103     3    C-C        1        0
DSWT5418  DSWT5418      3      3     3    C-C        0        1
          SC4Z          3    103     3    C-C        1        0
DSWT4673  DSWT4673      3      3     3    C-C        0        1
          SC2Z          3    103     3    C-C        1        0
DSWT5141  DSWT5141     45     45    45   VTAM        0        1
          PS3X         45    145    45   VTAM        1        0
DSWT4391  DSWT4391      2      2     2    C-C        0        1
          SC4Y          2    102     2    C-C        1        0
DSWT3324  DSWT3324     17     17    17   VTAM        0        1
          IT1Y         17    117    17   VTAM        1        0
DSWT4781  DSWT4781      3      3     3    C-C        0        1
          SC4Z          3    103     3    C-C        1        0
DSWT3525  DSWT3525      3      3     3    C-C        0        1
          SC6Z          3    103     3    C-C        1        0
DSWT4542  DSWT4542      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT5796  DSWT5796      3      3     3    C-C        0        1
          SC2Z          3    103     3    C-C        1        0
DSWT4782  DSWT4782      3      3     3    C-C        0        1
          SC6Z          3    103     3    C-C        1        0
DSWT4633  DSWT4633      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT3655  DSWT3655     12     12    12   VTAM        0        1
          SC6U         12    112    12   VTAM        1        0
DSWT3892  DSWT3892      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT3338  DSWT3338      4      4     4   VTAM        0        1
          SC2U          4    104     4   VTAM        1        0
DSWT4681  DSWT4681      3      3     3    C-C        0        1
          SC4Z          3    103     3    C-C        1        0
DSWT4482  DSWT4482      2      2     2    C-C        0        1
          SC6Y          2    102     2    C-C        1        0
DSWT4902  DSWT4902      3      3     3    C-C        0        1
          SC2Z          3    103     3    C-C        1        0
DSWT4558  DSWT4558      3      3     3    C-C        0        1
DSWT4558  SC6Z          3    103     3    C-C        1        0
DSWT3925  DSWT3925      2      2     2    C-C        0        1
TOTAL TRAFFIC
                                                  1353     1359
```

Figure 154. MSC-Traffic Report

Assessing the Effect of Link Loading

The MSC-Summaries report shows you the enqueue and dequeue activity for messages that are handled by the local system but are part of the multiple system coupling traffic. The report format is illustrated in Figure 155 on page 416.

The first set of queuing counts shows how many transactions of each type were entered in the monitor interval, and how many were subsequently dequeued.

The second set of counts summarizes the total traffic for each destination name. You can distinguish the primary transactions and responses by the resource names and examine the relative servicing of the link transmissions using the difference between the enqueue and dequeue counts.

The third set of counts lists the active links by link number, and you can determine if there is buildup on the link by the difference in the enqueue and dequeue counts.

The fourth set of counts records the traffic that is going to other systems by all link paths. You can judge by the difference in enqueue and dequeue counts whether the overall pattern of link priorities to one or more systems is causing buildup of cross-system traffic.

```
     IMS MONITOR   ****MSC SUMMARIES****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0178
<----SUMMARY BY INPUT NAME----->|<---SUMMARY BY DESTINATION NAME--->|<--SUMMARY BY LOGICAL LINK--->|<---SUMMARY BY DEST. SYS. ID-->

 INPUT     ENQUEUE   DEQUEUE    |    DESTIN.   ENQUEUE   DEQUEUE    |    LINK  ENQUEUE   DEQUEUE    |    DEST.  ENQUEUE   DEQUEUE
  NAME       COUNT     COUNT    |     NAME       COUNT     COUNT    |    NO.     COUNT     COUNT    |     SID     COUNT     COUNT
  ____       _____     _____    |     ____       _____     _____    |    ___     _____     _____    |     ___     _____     _____
                                |                                   |                                |
DSWT3577         1         1    |   DSWT4358         0         1    |                                |
DSWT4048         1         1    |   DSWT5988         0         1    |                                |
DSWT5216         1         1    |   DSWT5457         0         1    |                                |
DSWT4776         1         1    |   DSWT5187         0         1    |                                |
DSWT5496         1         1    |   DSWT3312         0         2    |                                |
DSWT5277         1         1    |   DSWT5604         0         1    |                                |
DSWT5711         1         1    |   DSWT3347         0         1    |                                |
DSWT5274         1         1    |   DSWT5338         0         1    |                                |
DSWT5807         1         1    |   DSWT3268         0         1    |                                |
DSWT3685         1         1    |   DSWT3676         0         1    |                                |
DSWT6161         1         1    |   DSWT5428         0         1    |                                |
DSWT3838         1         1    |   DSWT5395         0         1    |                                |
DSWT4618         1         1    |   DSWT4168         0         1    |                                |
DSWT3903         1         1    |   DSWT5061         0         1    |                                |
DSWT5418         1         1    |   DSWT3511         0         1    |                                |
DSWT4673         1         1    |   DSWT3363         0         1    |                                |
DSWT5141         1         1    |   DSWT3674         0         1    |                                |
DSWT4391         1         1    |   DSWT4467         0         1    |                                |
DSWT3324         1         1    |   DSWT4501         0         1    |                                |
DSWT4781         1         1    |   DSWT5037         0         1    |                                |
DSWT3525         1         1    |   DSWT4298         0         1    |                                |
DSWT4542         1         1    |   DSWT5778         0         1    |                                |
DSWT5796         1         1    |   DSWT4003         0         1    |                                |
DSWT4782         1         1    |   DSWT3988         0         1    |                                |
DSWT4633         1         1    |   DSWT4217         0         1    |                                |
DSWT3655         1         1    |   DSWT6135         0         1    |                                |
DSWT3892         1         1    |   DSWT5147         0         1    |                                |
DSWT3338         1         1    |   DSWT5381         0         1    |                                |
DSWT4681         1         1    |   DSWT5593         0         1    |                                |
DSWT4482         1         1    |   DSWT3304         0         1    |                                |
DSWT4902         1         1    |   DSWT5081         0         1    |                                |
DSWT4558         1         1    |   DSWT4671         0         1    |                                |
                                |   DSWT3655         0         1    |                                |
                                |   DSWT3892         0         1    |                                |
                                |   DSWT3338         0         1    |                                |
                                |   DSWT4681         0         1    |                                |
                                |   DSWT4482         0         1    |                                |
                                |   DSWT4902         0         1    |                                |
                                |   DSWT4558         0         1    |                                |
                                |   DSWT3925         0         1    |                                |
```

Figure 155. MSC-Summaries Report

Assessing Link Queuing Times

The MSC-Queuing-Summary report provides information about intersystem message traffic only. You can use the sample of traffic recorded in the IMS Monitor interval to examine the maximum and average time messages spend in queues waiting to be sent on active links. You can detect whether the link priorities are causing undue delay of primary messages through the intermediate system, or

whether there is a build up of responses. The report shows the logical link paths for this system which is an intermediate system. Each incoming link number shows the number of messages that are queued before transmission on their specified outward bound link number. The maximum queue count is given as well as the maximum and average time on the intermediate system queues.

The report is illustrated in Figure 156.

```
     IMS MONITOR   ****MSC QUEUING SUMMARY****         TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0180
 ENQUE.....     DEQUE.....                MAX.Q         MAX.         MEAN     DIST.
LINK NO.TYPE   LINK NO.TYPE   MESSAGES   LENGTH       Q TIME       Q TIME   NUMBER

_______ ____   _______ ____   ________   ______       ______       ______   ______
    46  VTAM       46  VTAM         12        1        31468         9521     1475
    49  VTAM       49  VTAM         15        1        30235         8040     1503
    50  VTAM       50  VTAM         10        1        13042         5521     1539
    48  VTAM       48  VTAM          9        1         7730         4429     1762
    47  VTAM       47  VTAM          8        1        10035         5791     1998
TOTALS...                          54                                6967
```

Figure 156. MSC-Queuing-Summary Report

Extracting Multiple System Transaction Statistics

You can use the Log Transaction Analysis utility to obtain counts of the message traffic both in local systems and between systems. The transmissions over the different types of physical links can also be examined. The activity is summarized for each step of the logical link paths. You must provide IMS system log input that reflects all partner system activity, that is, sets of system logs for each MSC system. To coordinate the sets of individual system logs use the Log Merge utility. Up to nine separate system logs can be merged; each log must be the output of a uniquely identified IMS system with MSC installed.

Controlling the Log Merge

To control the log output, you must:

- Choose the required systems that take part in the logical link paths you are examining.
- Coordinate the series of input logs for each system so that they cover a similar time span.
- Specify a start and stop time for the Log Merge utility control statements if you are sampling the cross-system processing for a particular interval.

  You can give both start date (Julian) and time of day, or just time of day. These times apply to the first system log specified by the LOG01 DD statement. Other log activity is collected if it falls between the initial and final events present on the first log.
- Specify `MSG` to select log records that are suitable for the transaction analysis step. (ALL records is the default, but this includes the DL/I activity for several systems in the utility input and this can cause extended processing time.)

Interpreting the Transaction Analysis Report

You can use the Log Analysis report produced by the Log Transaction Analysis utility to obtain the following statistics for individual transactions processed in any system:

- The total response time
- The time on input and output queues
- The processing time

Chapter 22, “Interpreting Statistical-Analysis and Log-Transaction Reports,” on page 491 defines the format of the detailed report records produced by this utility, provides a list of processing type codes, and shows an illustration of the report. The absence of times for a message GU call or MPP termination in the report lines indicate an input source or intermediate system report line.

The processing type field is an important one for the interpretation of the detailed report lines. The S code indicates that this line shows a send or receive event for the transaction. You can trace the progress of a cross-system conversation using the codes C, D, P, X, and Y.

The report headings include a column headed `ID` after the column for the `GU` to the message queue time. The number shown in a report line under the ID heading matches the sequence in which log input was fed to the Log Merge utility. The field corresponds to starting position 102, the 3-digit field named `SYSTEM ID`, in the detailed report records.

You can use the sort step to order the report records by system ID within transaction code, or other convenient sequences, rather than by the default of the overall input sequence.

Chapter 19. Interpreting IMS Monitor Reports for DBCTL

This chapter describes:

- The events that the IMS Monitor collects
- The content of the reports produced by the IMS Monitor Report Print Program

Monitoring has different meanings for DBCTL and DB/DC. For DB/DC, the end user enters the transaction on a terminal. The transaction is processed by IMS and then returns a result to the user. Transaction characteristics that are monitored include total response time and the occurrences of resource contentions (for example, PSB schedule wait time, and database I/Os).

DBCTL, on the other hand, has neither transactions nor terminal end users. It does, however, work on behalf of transactions entered by CCTL terminal users. DBCTL monitoring provides data about the processing that occurs when a CCTL transaction accesses DBCTL databases. The CCTL gains this access using DRA requests.

A typical sequence of these DRA requests would be:

1. A SCHED request to get a PSB scheduled in DBCTL
2. A DL/I request to make database calls
3. A sync-point request, COMMTERM, to commit the updates and release the PSB

The DBCTL process that encompasses these requests is called a unit of recovery (UOR).

DBCTL provides monitoring data about UORs, such as: total time UOR existed, wait time for PSB schedule, and I/Os during database calls. This information is very similar to IMS transaction monitor data. In a DBCTL-CCTL system, however, the UOR data represents only part of the total processing of a CCTL transaction. Therefore, CCTL monitor data is necessary to get a total view of CCTL transaction performance.

DBCTL does not change the format or usage of the IMS monitor reports. There are reports and fields within reports that are not applicable to DBCTL. Generally, these are in the transaction manager and communication areas. There are some fields that are interpreted differently in a DBCTL environment.

For reports that do not apply to DBCTL, either a heading without data is shown or no report is generated. These reports are:

- Message Queue Pool report
- Message Format Buffer Pool report
- Communication Summary report
- Communication IWAIT report
- Line Functions report
- MSC Traffic report
- MSC Summaries report
- MSC Queuing Summary report

The term *region* in IMS Monitor reports refers to a PST assigned to a specific dependent region that processes specific IMS transactions. In DBCTL monitor reports the term *region* still applies to a PST. A PST can service one CCTL thread (transaction) at a time. However, CCTL threads change, resulting in one PST

servicing many different CCTL transactions. Since multiple CCTLs can connect to DBCTL, the PST can actually service transactions from different CCTLs.

All of the threads built for a CCTL carry the job name of the CCTL. This appears as the same job name for many regions in the General Reports.

Within a trace interval, a thread can be assigned to multiple CCTLs, but it can only be assigned to one CCTL at any instant of time. So, depending on the number of CCTLs attached to DBCTL, the Region Summary reports can show:

- One region with only one job name.
- One region with different job names.
- Multiple regions with different job names. Some regions can have the same job name and some can have different job names.
- Multiple regions with only one job name.

Any monitor report for a region is a summary of all the CCTLs a thread served during the trace interval (for example, the elapsed time for all CCTLs that a thread has been assigned to during the trace interval).

The reports generated by the IMS Monitor are the same for BMPs and non-message BMPs.

UOR elapsed times are spent in DBCTL, not in the DRA. The time spent in the DRA is considered part of the CCTL, therefore the DRA time is not reported by any DBCTL statistics.

The following topics provide additional information:

- "IMS Monitor Trace Event Intervals"
- "Overview of IMS Monitor Reports" on page 421
- "Documenting the Monitoring Run" on page 422
- "Monitoring Activity in Dependent Regions" on page 424
- "Monitoring Application Program Elapsed Time" on page 429
- "Monitoring Database Buffers" on page 433
- "IMS Internal Resource Usage" on page 435
- "Using Frequency Distributions from IMS Monitor Output" on page 436

IMS Monitor Trace Event Intervals

The IMS Monitor trace interval is defined by the master terminal operator's use of the `/TRACE` command between the start and stop command entries. The online IMS events are recorded in IMS Monitor records placed in the IMSMON data set. The event timings are related to dependent region activity. Figure 157 on page 421 shows the boundaries of the timed event intervals.

The Monitor trace interval includes the following intervals:

- Scheduling and Termination
  - Block loader busy
  - Intent failures (exclusive intent and data sharing) and Schedule failures (PSB busy and space failure)
  - Sched/Term elapsed
    - NOT-WAIT

  - ACBLIB waits
  - DB Flush waits
  - DB CLOSE waits
- Region occupancy (which overlaps with all of Sched/Term elapsed)
  – Schedule to first call
  – Elapsed execution

The NOT-WAIT time for a region is the elapsed time not accounted for by wait time. Any delay coming from either paging or the processor being dispatched for a higher priority task results in an increase in the NOT-WAIT times.

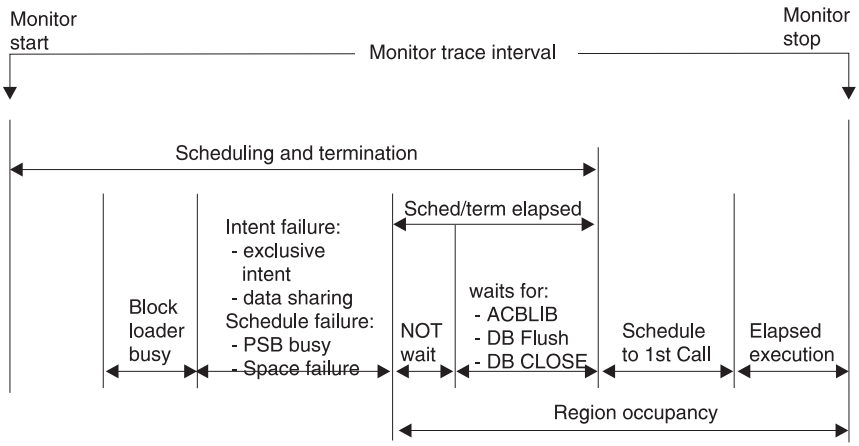


Figure 157. IMS Monitor Trace Event Intervals

Overview of IMS Monitor Reports

A list of reports available from data collected by the IMS Monitor, together with the principal performance data they contain, is shown in Table 38.

Related Reading: For a description of those reports marked “DB”, see *IMS Version 9: Utilities Reference: Database and Transaction Manager*.

Sequence of Report Output

The order of the reports listed in Table 38 matches the sequence of the output from the IMS Monitor Report Print program. The duration of a monitoring snapshot might not include certain events necessary for an individual report, in which case only report headings or partial data are produced.

Table 38. IMS Monitor Reports Output Sequence and Information

Report Name	Principal Information
System Configuration	Monitor run documentation
Database Buffer Pool (DB)	Count of DB calls and I/O per transaction
VSAM Buffer Pool (DB)	Count of inserts and I/Os
Latch Conflict Statistics	IMS internal processing
Region and Jobname	Monitor run documentation
Region Summary	Elapsed times and count of DL/I calls
Region Wait	Wait times

Table 38. IMS Monitor Reports Output Sequence and Information (continued)

Report Name	Principal Information
Programs by Region	Elapsed times for region usage
Program Summary	Overall program statistics
Program I/O (DB)	Wait times/PCB
Reports	Count of space failures and deadlocks
Run Profile	Monitor run documentation
Call Summary (DB)	Call counts and timings/segment type
Distribution Appendix	Event frequency distributions

Units of Measure in IMS Monitor Reports

The majority of the data items in IMS Monitor reports are elapsed times. These are normally expressed in microseconds. An entry of 1876534 is 1.876534 seconds or 1876 milliseconds. Any times that do not follow this convention show the unit of measure on the report.

You can also find counts of events under the heading `OCCURRENCES`, and some figures that represent the number of bytes.

Documenting the Monitoring Run

For each trace interval, several general reports or overall summaries are generated for the processing that took place. You can use these reports as part of your IMS Monitor run documentation.

It is important to record, as accurately as possible, the conditions under which the trace was taken. Your documentation can include system status information (obtained by the `/DISPLAY` command) several times before and after the trace, an expected profile of the CCTL transaction activity, and any desired processing events. The trace interval should represent typical processing loads and not be a biased or inadequate historical record.

Adding to the System Configuration Report Data

The first general report (titled `SYSTEM CONFIGURATION`) is found under the page heading `BUFFER POOL STATISTICS`. It shows the modification level of the IMS and z/OS systems. You can choose to add a list of IMS APARs applied and include the service levels of the application programs, especially if the latter are not permanent programs or are part of a staged implementation. The system configuration output is illustrated in Figure 158 on page 423.

Recording the Monitor Trace Interval

The heading of most IMS Monitor reports carries the trace start and stop times. It is shown in the format `YEAR DAY (Julian) HH:MM:SS`. The overall length of the trace interval is given in milliseconds under the title `MONITOR OVERHEAD DATA`. The following line shows how many trace records were placed on the IMSMON data set. An example of the monitor trace interval recording is shown in Figure 158 on page 423.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0001

                S Y S T E M   C O N F I G U R A T I O N


                                          SYSTEM CONFIGURATION      :
                                             IMS VERSION            :   4
                                          RELEASE LEVEL             :
                                          MODIFICATION NUMBER       :
```

Figure 158. IMS Monitor System Configuration Report and Trace Interval

Completing the Monitor Run Profile

A compact set of processing ratios will be found at the end of the Run Profile report. The statistics summarize, for the monitor interval, the UOR throughput and the degree of DL/I and I/O activity. An example of the report is shown in Figure 159.

```
     IMS MONITOR   **RUN PROFILE**                    TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0184
TRACE ELAPSED TIME IN SECONDS.............274.6
TOTAL NUMBER OF MESSAGES DEQUEUED........1403
TOTAL NUMBER OF SCHEDULES.................173
NUMBER OF TRANSACTIONS PER SECOND...........5.1
TOTAL NUMBER OF DL/I CALLS ISSUED.......18632
NUMBER OF DL/I CALLS PER TRANSACTION.......13.2
NUMBER OF OSAM BUFFER POOL I/O'S........11236,    8.0 PER TRANSACTION
NUMBER OF MESSAGE QUEUE POOL I/O'S..........0,    0.0 PER TRANSACTION
NUMBER OF FORMAT BUFFER POOL I/O'S..........0,    0.0 PER TRANSACTION
RATIO OF PROGRAM ELAPSED TO DL/I ELAPSED:
              REGION   1:   1.09
              REGION   2:   1.09
              REGION   3:   1.00
              REGION   4:   1.02
              REGION   5:   1.01
              REGION   6:   1.00
              REGION   7:   1.00
              REGION   8:   1.00
              REGION   9:   1.17
              REGION  10:   1.00
              REGION  11:   1.00
              REGION  49:   1.03
              REGION  50:   1.19
RATIO OF DL/I ELAPSED TO DL/I IWAIT:
              REGION   1: 325.65
              REGION   2:  73.49
              REGION   4: 100.35
              REGION   5:  85.76
              REGION   6:  82.99
              REGION  47:  95.64
              REGION  48:  45.93
              REGION  49:   9.22
```

Figure 159. Run Profile Report

The lower half of the Run Profile report shows several ratios:

- Program elapsed time to DL/I elapsed time for each region
- DL/I elapsed time to wait time during DL/I processing
- Program elapsed time to other subsystem call elapsed time
- DL/I elapsed time to other subsystem call elapsed time

Each region is identified by a sequence number, starting at region 1.

There are some generalized processing ratios that are given at the end of several buffer pool statistics reports. You can include them in the documented profile of the trace interval. These are not specific to one UOR or system resource but can be used as indicators of variation across a series of monitor runs. The ratios are:

- The total number of OSAM reads + OSAM writes + all waits divided by the total number of transactions.

  From the Message Queue Pool report, this ratio indicates on a per transaction basis the physical I/O activity required to handle the scheduling function.
- The total number of OSAM reads + OSAM writes + BISAM reads divided by the total number of transactions.

  From the Database Buffer Pool report, this ratio indicates on a per transaction basis the physical I/O activity required to handle the database buffering function.

Verifying IMS Monitor Report Occurrences

When you examine the output from the IMS Monitor Report Print Program, the presence of a report heading does not necessarily mean that appropriate data will be listed. System definition options and utility control statements also affect the content of the output as follows:

- The output does not include a Call Summary report unless a control statement specifies `DLI`.
- The output does not include a set of Distribution reports unless a control statement specifies `DIS` or `DISTRIBUTION`. The column headed `DISTRIBUTION NUMBER` that occurs on many of the reports contains cross-references to items included in the Distribution reports.
- The output consists of just a Call Summary report if a control statement specified `ONLY DLI`.

Because many of the summary reports require system status to calculate the difference between start and end values, and this status is obtained during the `/TRACE SET OFF` processing, the IMS Monitor execution must end before termination of the IMS control region. If the trace was not stopped properly, the following message is issued:

```
NO DATABASE BUFFER POOL TRACES AT END TIME ON MONITOR LOG TAPE
****DATABASE BUFFER POOL REPORT CANCELLED****
```

Similarly, other summary reports are not produced.

The series of reports titled `Buffer Pool Statistics` do not include a VSAM Buffer Pool section unless the database in IMS.ACBLIB uses the VSAM access method. If VSAM is not used, the following message is issued:

```
NO VSAM BUFFER POOL TRACES ON MONITOR LOG TAPE
****VSAM BUFFER POOL REPORT CANCELLED****
```

If the source data used to formulate a particular IMS Monitor report, or a section of that report, has not been recorded by the IMS Monitor during the trace interval, the report contains only the headings.

Monitoring Activity in Dependent Regions

The IMS Monitor gathers timing information for every dependent region identified in the /trace command (a CCTL thread) active during the trace interval. It records the total of the elapsed times for each event, the maximum individual time encountered, and the average time.

There are three major reports that display timings. The reports and a list of their content are:

- **Region Summary Report**

  - Scheduling and termination
  - Schedule end to first call
  - Elapsed execution with separate summaries shown for:
    - DL/I calls
    - External subsystem service and command calls
    - External subsystem database access calls
    - Checkpoint processing
    - Region occupancy
- **Region Wait**
  - Waits during scheduling and termination
  - Waits during DL/I calls
  - Waits during external subsystem calls
  - Waits during checkpoint
- **Programs by Region**
  - Elapsed execution
  - Schedule end to first call

In this report, “program name” is the PSB name for the UOR.

These three reports are illustrated in Figure 160 on page 426, Figure 161 on page 427, and Figure 162 on page 428.

Activities in dependent regions are placed in five timing categories:

- Elapsed time for scheduling and termination

  The scheduling process includes many preparatory events such as block loading from an active IMS.ACBLIBA/B data set, and obtaining ownership of the PSB. The time required to terminate is the time it takes DBCTL to complete this process after receiving a request to terminate the UOR.
- Elapsed time from end of schedule to first call

  This is the time from when DBCTL completes scheduling until the time DBCTL reviews the first DL/I call. Events that occur during this time are all outside of DBCTL, either in the DRA or the CCTL.
- Program elapsed time, including all calls

  This time encompasses the major UOR processing, measured from the first DL/I call to the call that terminates a UOR.
- Elapsed time performing DL/I calls

  This time includes all DL/I calls. The time in DBCTL is recorded and summed.

```
     IMS MONITOR   ****REGION SUMMARY****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0011
                                                (A)                                (B)
                                      .........ELAPSED TIME.........      NOT IWAIT TIME(ELAPSED-IWAIT)                DISTRIBUTION
                 OCCURRENCES          TOTAL        MEAN     MAXIMUM        TOTAL        MEAN     MAXIMUM                  NUMBER
                 ___________          _____        ____     _______        _____        ____     _______                  ______
SCHEDULING AND TERMINATION
_________ ___ ___________
**REGION     5           5           4146         829         948         4146         829         948                    287A,B
**REGION     6           7           6028         861        1067         6028         861        1067                    214A,B
**REGION     8           8           6847         855        1098         6847         855        1098                    129A,B
**REGION    10           7           9664        1380        3668         9664        1380        3668                    272A,B
**REGION    47           6           5482         913        1021         5482         913        1021                    145A,B
**REGION    49           3           2612         870         917         2612         870         917                    443A,B
**TOTALS               123         126042        1024                    126042        1024
SCHEDULE TO FIRST CALL
________ __ _____ ____
**REGION     1           1       15479797    15479797    15479797                                                        555
**REGION     2           1       22376350    22376350    22376350                                                        564
**REGION     3           1       15169488    15169488    15169488                                                        578
**REGION     4           1       48146258    48146258    48146258                                                        584
**REGION    48           1         795351      795351      795351                                                        592
**REGION    49           4        2960425      740106     2951746                                                        442
**REGION    50           1       15713464    15713464    15713464                                                        575
**TOTALS               168      514286738     3061230
ELAPSED EXECUTION
_______ _________
**REGION     1           1      290146255   290146255   290146255                                                          1
**REGION     2           1      252290108   252290108   252290108                                                          2
**REGION     3           1      259496970   259496970   259496970                                                          3
**REGION     4           1      322812716   322812716   322812716                                                          4
**REGION    48           1      273871107   273871107   273871107                                                         48
**REGION    49           4      271703421    67925855   155176058                                                         49
**REGION    50           1      290379922   290379922   290379922                                                         50
**TOTALS               173    14238540145    82303700
DL/I CALLS                                                                                                  IWT/CALL(C)
____ _____                                                                                                  _________
**REGION     1          60      264626241     4410437    88981490    263813671     4396894    88970053          0.76        247A,B,C
**REGION     2         223      230505269     1033655    61048758    227368742     1019590    61011153          0.73        237A,B,C
**REGION     3          29      257704383     8886358    69000514    257704383     8886358    69000514          0.00         98A,B,C
**REGION     4         792      313735347      396130    52439653    310609035      392183    52439653          0.22        180A,B,C
**REGION    49         592      262886317      444064    30202068    234394017      395935    30159782          2.46        177A,B,C
**REGION    50          36      242591451     6738651    48651260    242591451     6738651    48651260          0.00        289A,B,C
**TOTALS             18632    12386905286      664818            12024562411      645371                       0.97
IDLE FOR INTENT
____ ___ ______
                      NONE
CHECKPOINT
__________
                      NONE
REGION OCCUPANCY
______ _________
**REGION     1    100.0%
**REGION     2    100.0%
**REGION     3    100.0%
**REGION     4    100.0%
**REGION    48    100.0%
**REGION    49    100.0%
**REGION    50    100.0%
```

Figure 160. Region Summary Report

```
     IMS MONITOR   ****REGION IWAIT****               TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0023
                                .........IWAIT TIME.........                                DISTRIBUTION
**REGION     5 OCCURRENCES       TOTAL        MEAN     MAXIMUM       FUNCTION  MODULE       NUMBER
  ______      ___________       _____        ____     _______       ________  ______       ______
SCHEDULING + TERMINATION
_________  ___________
   SUB-TOTAL
   _________
   TOTAL
   _____
DL/I CALLS
____ _____
                      11      181816       16528       24375    DD=IMMSTR2A   DBH            117
                       8      112831       14103       17846    DD=IMMSTR1A   DBH            118
                       5       85460       17092       33717    DD=IMMSTR3A   DBH            119
                       5       58420       11684       14643    DD=IMINDEXA   VBH            120
                      12      173866       14488       22152    DD=PRODCNTA   VBH            121
                       3      100576       33525       68373    DD=IMMSTR2B   DBH            428
                       1       17921       17921       17921    DD=IMMSTR3B   DBH            429
                       1       17195       17195       17195    DD=IMMSTR1B   DBH            430
                       1       13577       13577       13577    DD=IMINDEXB   VBH            431
                       3       49928       16642       20396    DD=PRODCNTB   VBH            432
                       4       10973        2743        2787    DD=ITEMACTB   DBH            453
                       2       37680       18840       27664    DD=IAINDEXB   VBH            454
                      49     1500067       30613      138284    DD=INVENTRA   DBH            472
                      23      345595       15025       27613    DD=VENDORDA   VBH            473
                       1      342952      342952      342952    PI=VENDORDA...1              498
                       1       14612       14612       14612    PI=VNSINDXA...1              499
                       6       69203       11533       19492    DD=VNSINDXA   VBH            500
   TOTAL
   _____             136     3132672       23034
```

Figure 161. Region Wait Report

```
     IMS MONITOR   ****PROGRAMS BY REGION****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0069
                                                (A)                                  (B)
                                  ELAPSED EXECUTION TIME            SCHEDULING END TO FIRST CALL      DISTRIBUTION
                OCCURRENCES       TOTAL        MEAN     MAXIMUM       TOTAL        MEAN     MAXIMUM       NUMBER
                ___________       _____        ____     _______       _____        ____     _______       ______
**REGION     1
________ _ 1
    PROGSC6D            1   290146255   290146255   290146255    15479797    15479797    15479797         885A,B
 REGION TOTALS          1   290146255   290146255                15479797    15479797
**REGION     2
________ _ 2
    PROGIT8C            1   252290108   252290108   252290108    22376350    22376350    22376350         889A,B
 REGION TOTALS          1   252290108   252290108                22376350    22376350
**REGION     3
________ _ 3
    PROGTS1C            1   259496970   259496970   259496970    15169488    15169488    15169488         893A,B
 REGION TOTALS          1   259496970   259496970                15169488    15169488
**REGION     4
________ _ 4
    PROGPS3D            1   322812716   322812716   322812716    48146258    48146258    48146258         897A,B
 REGION TOTALS          1   322812716   322812716                48146258    48146258
**REGION     5
________ _ 5
    PROGPS3A            2    62893103    31446551    40693590        5435        2717        2862         901A,B
    PROGTS1B            1    61794787    61794787    61794787        2790        2790        2790        1271A,B
    PROGPS3B            1    18294458    18294458    18294458        3104        3104        3104        1350A,B
    PROGIT2B            1    36095342    36095342    36095342        2731        2731        2731        1363A,B
    PROGSC2A            1    93902771    93902771    93902771     1667791     1667791     1667791        1401A,B
 REGION TOTALS          6   272980461    45496743                 1681851      280308
**REGION     6
________ _ 6
    PROGIT1B            2    39000315    19500157    23703429        5286        2643        2801         905A,B
    PROGTS1B            1    34293636    34293636    34293636        3136        3136        3136        1207A,B
    PROGPS3A            1    51887767    51887767    51887767        2534        2534        2534        1278A,B
    PROGPS3B            2    67375031    33687515    40291430    17210570     8605285    17213287        1328A,B
    PROGIT8A            1    69132416    69132416    69132416        3291        3291        3291        1359A,B
    PROGSC4A            1    30165017    30165017    30165017        2571        2571        2571        1433A,B
 REGION TOTALS          8   291854182    36481772                17193752     2149219
**REGION     7
________ _ 7
    PROGSC2B            1   269618583   269618583   269618583     5047875     5047875     5047875         909A,B
 REGION TOTALS          1   269618583   269618583                 5047875     5047875
**REGION     8
________ _ 8
    PROGIT8A            1     5181039     5181039     5181039        2928        2928        2928         913A,B
    PROGPS3A            1    27304257    27304257    27304257        3350        3350        3350        1132A,B
    PROGSC4B            1    37286872    37286872    37286872        3009        3009        3009        1255A,B
    PROGIT2A            1    36902995    36902995    36902995        2850        2850        2850        1298A,B
    PROGIT1B            1    30407479    30407479    30407479        2565        2565        2565        1336A,B
    PROGIT1A            3   109875360    36625120    45190114     4279008     1426336     4272096        1357A,B
    PROGIT8B            1    23405220    23405220    23405220        2679        2679        2679        1395A,B
 REGION TOTALS          9   270363222    30040358                 4296389      477376
```

Figure 162. Programs-by-Region Report

Detecting Database Processing Intent Conflicts

The IMS Monitor records the intervals when a region is in an idle state waiting to update a database owned exclusively by another already scheduled application program.

You can see the total, maximum, and average idle times in `IDLE FOR INTENT` following the DL/I calls. The elapsed time during the unsuccessful scheduling of a program in that region is included in the summary line times for that region.

The region can fail to be scheduled even when ownership of that database is released. The number of times processing is held up by intent failure is separately tallied under the title `INTENT FAILURE SUMMARY`. The report is illustrated in Figure 135 on page 393. This report shows which PSBs are in conflict because of exclusive intent for a segment type and the database name in question.

Examining the Effects of Checkpoints

The checkpoint line of the Region Summary report at the end of the region 0 summary, shows the following:

- The number of times that a system checkpoint is taken during the monitor interval
- The elapsed times
- The not-wait times

Checkpoint processing can be initiated by the control program at a specified frequency determined by the number of records placed on the system log. Other checkpoints can be caused by operator commands.

The wait time experienced during checkpoints is reported at the end of the first region summary on the Region Wait report. You can detect delays for each combination of ddname and module code. Typical entries here are for the message queue data sets and the restart data set. If a wait for storage is the cause, the entry under the `FUNCTION` column is `STG.=` followed by the identification of the pool.

Measuring Region Occupancy

Region occupancy shows the ratio of elapsed time a PST spent processing UORs to the total time of the monitor interval.

Monitoring Application Program Elapsed Time

The IMS Monitor can record measurements of elapsed times for each UOR. It does this during the monitored interval while other UORs are executing concurrently. Elapsed times are calculated from the start of the first DL/I (or other) call to the end of that program. You can distinguish between time spent in application code and in DL/I processing. The event intervals are illustrated in Figure 163.

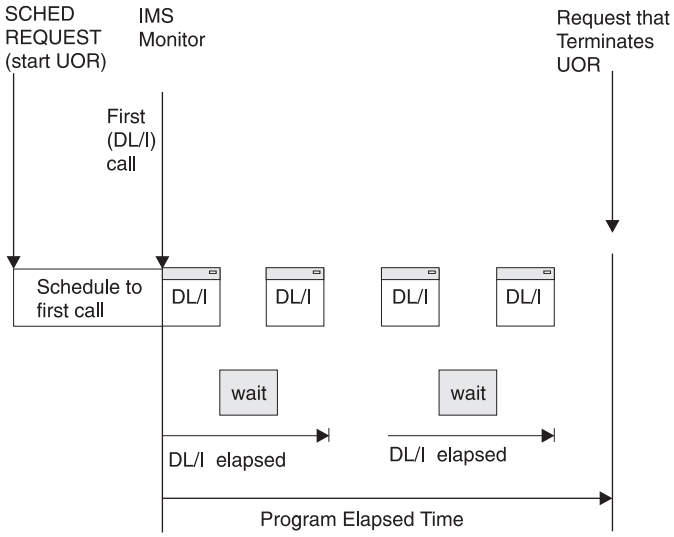


Figure 163. Event Intervals

Within the elapsed time for a DL/I call, the wait time to obtain segment data is recorded separately. Also, the elapsed time from schedule to first call is separately recorded. This time covers the processing in the CCTL and the DRA.

The elapsed times are given in the Program Summary report. Figure 164 is an example of the report. Programs are identified by their PSB name on individual lines in the report. Each line gives a summary of the activity for that PSB during the measured interval. The total number of schedules, DL/I calls, transactions dequeued, and waits for a DL/I call for I/O are given. The report line gives calculated average times for elapsed time per schedule, processor time per schedule, schedule to first DL/I call per schedule, and elapsed time per transaction. Frequencies for calls per transaction, I/O waits per DL/I call, and transactions dequeued per schedule are also given. A TOTALS line summarizes all activity for the PSBs active during the monitored interval. (The PSB DUMMY line is a reconciliation for any incomplete scheduling caused by a region being stopped during scheduling or for a program that experiences a pseudoabend.)

In this report, *transaction* and *schedule* can be interpreted as UOR.

```
     IMS MONITOR   ****PROGRAM SUMMARY****            TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0075
                                                              (A).....(B).....                    (A).....(B).....
                                                        I/O   TRAN.      CPU       .          ELAPSED    SCHED.TO     .        ELAPSED
           NO.    TRANS.            CALLS     I/O   IWAITS  DEQD.     TIME    DISTR.         TIME      1ST CALL  DISTR.       TIME
PSBNAME  SCHEDS.   DEQ.     CALLS  /TRAN    IWAITS  /CALL  /SCH.    /SCHED.   NO.          /SCHED.     /SCHED.    NO.       /TRANS.
_______  _______   ____     _____  _____    ______  _____  _____    _______   ___          _______     _______    ___       _______

PROGSC6D       1      13        60    4.6        46    0.7   13.0       10010   884A,B    290146255    15479797   886A,B    22318942
PROGIT8C       3      17       225   13.2       166    0.7    5.6       90592   888A,B    256617508    73283259   890A,B    45285442
PROGTS1C       2      25        47    1.8         0    0.0   12.5       10010   892A,B    239190808     7586234   894A,B    19135264
PROGPS3D       1      23       792   34.4       182    0.2   23.0       10010   896A,B    322812716    48146258   898A,B    14035335
PROGPS3A      13      36      1246   34.6       267    0.2    2.7       49782   900A,B     32801812     2228611   902A,B    11845098
PROGIT1B      11      21        99    4.7         0    0.0    1.9        6341   904A,B     23212388     2036217   906A,B    12158870
PROGSC2B       7     155      3068   19.7      1845    0.6   22.1      346112   908A,B     93655514      789390   910A,B     4229603
PROGIT8A      12      28       434   15.5       293    0.6    2.3       34350   912A,B     30196795     1745815   914A,B    12941483
PROGPS2C       1      10       179   17.9       205    1.1   10.0       10010   916A,B    221024429    53642029   918A,B    22102442
PROGTS1B       8      20        54    2.7         0    0.0    2.5        5447   920A,B     39943245        2895   922A,B    15977298
PROGPS3C       1      14       468   33.4       117    0.2   14.0       10010   924A,B    310644485    35978027   926A,B    22188891
PROGIT1C       1       9        32    3.5         0    0.0    9.0       10010   930A,B    304892631    30226173   932A,B    33876959
PROGSC2C       1       9       160   17.7       101    0.6    9.0       10010   934A,B    296909110    22242652   936A,B    32989901
PROGIT2B       8      21       393   18.7        63    0.1    2.6       21703   938A,B     35126671     1798496   940A,B    13381589
PROGIT2C       6      17       211   12.4        39    0.1    2.8       13312   942A,B    288883508    50698467   944A,B   101958885
PROGTS1D       2      26        50    1.9         0    0.0   13.0       10010   950A,B    284944505    10613350   952A,B    21918808
PROGPS3B       8      22       770   35.0       169    0.2    2.7       35737   954A,B     38016279     2149158   956A,B    13824101
PROGIT1A      11      24       106    4.4         0    0.0    2.1        7925   958A,B     30883486     1935855   960A,B    14154931
PROGSC4A       9     163      1775   10.8      5101    2.8   18.1      235921   963A,B     62172947     3011199   965A,B     3432862
PROGSC6C       1      10        44    4.4        38    0.8   10.0       10010   967A,B    228098334    46568124   969A,B    22809833
PROGPS2B      11      28       557   19.8       604    1.0    2.5       35069   971A,B     33309266     1181831   973A,B    13085783
PROGIT8D       1      12       175   14.5       133    0.7   12.0       10010   975A,B    253392289    21274169   977A,B    21116024
PROGSC4C       1      10        98    9.8       349    3.5   10.0       10010   979A,B    248736332    25930126   981A,B    24873633
PROGSC6A       7     157       789    5.0       457    0.5   22.4       11703   983A,B     73936039      115979   985A,B     3296511
PROGIT2A       7      22       430   19.5        71    0.1    3.1       28529   987A,B     37905001        2982   989A,B    12060682
PROGSC2D       1      15       280   18.6       180    0.6   15.0       10010   991A,B    316194222    41527764   993A,B    21079614
PROGPS2A       6      25       490   19.6       548    1.1    4.1       43177   995A,B     58277945     2467506   997A,B    13986707
PROGSC2A       5     121      2363   19.5      1420    0.6   24.2      276187  1001A,B     88906184     6022954  1003A,B     3673809
PROGIT2D       1      20       361   18.0        62    0.1   20.0       10010  1005A,B    386092737   111426279  1007A,B    19304636
PROGSC4B      10     131      1421   10.8      4115    2.8   13.1      617016  1011A,B     53826667     2632409  1013A,B     4108905
PROGSC4D       1      19       197   10.3       668    3.3   19.0       10010  1020A,B    227999124    46667334  1022A,B    11999953
PROGPS2D       1      13       240   18.4       291    1.2   13.0       10010  1025A,B    327602445    52935987  1027A,B    25200188
PROGSC6B       5     140       694    4.9       395    0.5   28.0       16884  1032A,B     78994223     3290769  1034A,B     2821222
PROGIT1D       1      10        36    3.6         0    0.0   10.0       10010  1041A,B    290379922    15713464  1043A,B    29037992
PROGIT8B       8      17       288   16.9       190    0.6    2.1       33436  1259A,B     35223857        2902  1261A,B    16575932
**TOTALS     173    1403     18632   13.2     18115    0.9    8.1       90328              82303700     2972755             10148638
```

Figure 164. Program Summary Report

To examine the detail of the call processing for each program (itemized by type of call and summarized for the monitor interval), you can use the Call Summary report. An extract from the multipage output is given in Figure 165 on page 431. The calls using an I/O PCB are given first and subtotaled. Then, the total calls, of each type, against each database PCB and each external subsystem are listed. The PSB TOTAL line marks the end of data for each program.

```
     IMS MONITOR   ****CALL SUMMARY****                TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0186
                                                                (C)              (A)                    (B)
                   CALL  LEV          STAT                          IWAITS/       ..ELAPSED TIME...       .NOT IWAIT TIME..   DISTRIB.
PSB NAME PCB NAME  FUNC  NO.SEGMENT   CODE   CALLS     IWAITS   CALL        MEAN      MAXIMUM       MEAN      MAXIMUM    NUMBER
________ ___ ____  ____  _ ________   ____   _____     ______   ____        ____      _______       ____      _______    ______
PROGSC6B I/O PCB   ISRT (  )                   138          0   0.00         372         1240         372         1240      598A,B,C
                   GU   (  )                   134        133   0.99     2600917     20974615     2587532     20962866      602A,B,C
                   (GU) (  )                     3          0   0.00          15           16          15           16      716A,B,C
                   ASRT (  )                     3          0   0.00         330          333         330          333      869A,B,C
                   GU   (  )          QC         2          1   0.50    17639806     21219588    17634776     21209529      870A,B,C
                   I/O PCB SUBTOTAL
                   ___ __ ________             280        134   0.47     1370910                  1364469
         INVENTRB  DLET (03)IN060SUP            138          0   0.00         813         1289         813         1289      599A,B,C
                   GNP  (03)IN060SUP            138          7   0.05        2112       112589        1047       112589      600A,B,C
                   GU   (01)IN010PAR            138        254   1.84       29511        75356        1195        19229      601A,B,C
                   DL/I PCB SUBTOTAL
                   ____ ___ ________            414        261   0.63       10812                     1018
                   PSB TOTAL
                   ___ _____                    694        395   0.56      559555                   551114
PROGSC2A I/O PCB   ISRT (  )                   118          0   0.00         381         1496         381         1496      603A,B,C
                   GU   (  )                   114        284   2.49     3304809     21784513     3164423     21664181      632A,B,C
                   (GU) (  )                     2          0   0.00          17           18          17           18      781A,B,C
                   ASRT (  )                     3          0   0.00         367          444         367          444      871A,B,C
                   GU   (  )          QC         2          5   2.50    19931897     20045206    19799530     19925277      872A,B,C
                   I/O PCB SUBTOTAL
                   ___ __ ________             239        289   1.20     1743339                  1675270
         LOGVENDA  REPL (03)IN040SLQ            118          0   0.00         268          804         268          804      604A,B,C
                   GNP  (03)IN040SLQ            118          5   0.04         899        16995         218          305      605A,B,C
                   REPL (02)VN030PAR            826          0   0.00         805         1578         805         1578      606A,B,C
                   GNP  (02)VN030PAR            826        873   1.05       19321        94521         456         1363      607A,B,C
                   REPL (01)VN020REO            118         58   0.49        8879        48076         832         1682      623A,B,C
                   GU   (01)VN020REO            118        195   1.65       31688       360775        1300         1746      625A,B,C
                   DL/I PCB SUBTOTAL
                   ____ ___ ________           2124       1131   0.53       10145                      636
                   PSB TOTAL
                   ___ _____                   2363       1420   0.60      185445                   170013
PROGSC2D I/O PCB   ISRT (  )                    14          0   0.00         377          621         377          621      608A,B,C
                   GU   (  )                    14         36   2.57    22360408     52048566    22221852     51901313      634A,B,C
                   I/O PCB SUBTOTAL
                   ___ __ ________             28         36   1.28    11180393                 11111115
         LOGVENDD  REPL (03)IN040SLQ            14          0   0.00         263          328         263          328      609A,B,C
                   GNP  (03)IN040SLQ            14          1   0.07        1407        16889         223          307      610A,B,C
                   REPL (02)VN030PAR            98          0   0.00         820         1015         820         1015      611A,B,C
```

Figure 165. Call Summary Report

Monitoring I/O for Application Program DL/I Calls

The IMS Monitor report shows the total number of I/O occurrences and the total time the occurrences took for each UOR during a monitored interval. The Program I/O report gives these two totals for all PSBs active during the monitored interval and includes the detailed breakdown of the I/O wait time as it was incurred by each PCB used by the program. Figure 139 on page 398 shows an example of the report.

The report shows any contention experienced during application program processing. Each type of conflict and the number of times it occurred are recorded for each I/O PCB or database PCB. The report shows the total wait time, the highest wait experienced, and the average time. Subtotals are given for each PCB under a PSB, and for all PCBs under each PSB.

The DDN/FUNC column list the data set by ddname. The MODULE column uses a code to indicate the source of the contention. The types of conflicts and codes are shown as follows. Any codes that appear apply to IMS only.

- **Scheduling**

Code	Conflict
BLR	Load/read from ACBLIB
SMN	Virtual storage management

- **Database access**

Code	Conflict
DBH	OSAM I/O
DLE	DL/I functions
VBH	VSAM interface
(Physical segment code)	Program isolation

The I/O waits for the calls to the I/O PCB are grouped as the first entries for a PSB. For DL/I calls, the data set for which the I/O took place is indicated under the DDN/FUNC heading, and the module code tells you what type of conflict caused the wait.

Contention for the same physical segment in a database causes a wait on behalf of program isolation. This is shown in the DDN/FUNC column, on the PCB line, by the entry PIdmb, where dmb is the DMB of the physical data set. The MODULE column identifies the segment type using the physical segment code assigned by DBD generation.

When an application is accessing a database using VSAM as the access method, DL/I calls do not generally result in an I/O wait. A MODULE column entry of VBH indicates that interface to VSAM occurred and there was an I/O wait.

A seemingly unrelated entry can occur under the DDN/FUNC column for a database PCB. An example is a retrieval call to a database (DB-A) that causes a buffer to be purged in order to make room for that retrieved data. If the buffer contents included data belonging to another database (DB-B), the I/O entry in the report shows the ddname for DB-B as being in conflict for PCB access to DB-A.

Transaction Queuing Report

In the Transaction Queuing Report in Figure 166 on page 433, a list of transactions is shown for DBCTL. Each transaction name is an 8-byte transaction ID specified by the CCTL on the schedule request or the CCTL ID. A transaction ID from CICS, when used as the transaction manager, is composed of a 4-byte CICS transaction name plus a 4-byte CICS identifier. If the CCTL does not specify the transaction ID, DBCTL takes the CCTL region ID obtained at connection time as the default. In this report for DBCTL, the transaction NUMBER DEQUEUED is the number of schedules, and the ON QUEUE WHEN SCHEDULED is always zero, because the IMS message queues are not involved.

```
     IMS MONITOR   ****TRANSACTION QUEUING****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0181
                                                              (B)                    (A)
                   NUMBER      NUMBER      ..ON QUEUE WHEN SCHEDULED.....    DEQUED      DISTRIBUTION
TRANSACTION        DEQUED      SCHEDS.     MINIMUM    MEAN        MAXIMUM    MEAN        NUMBER
___________        ______      ______      _______    ____        _______    ____        ______

 SC6X                13          1           0       0.00           0      13.00         883A,B
 IT8W                17          3           0       0.00           0       5.66         887A,B
 TS1Z                16          1           0       0.00           0      16.00         891A,B
 PS3X                23          1           0       0.00           0      23.00         895A,B
 PS3Y                17          7           0       0.00           0       2.42         899A,B
 IT1V                11          6           0       0.00           0       1.83         903A,B
 SC2Z               143          2           0       0.00           0      71.50         907A,B
 IT8U                12          7           0       0.00           0       1.71         911A,B
 PS2W                10          1           0       0.00           0      10.00         915A,B
 TS1U                12          4           0       0.00           0       3.00         919A,B
 PS3W                14          1           0       0.00           0      14.00         923A,B
 IT8Y                16          5           0       0.00           0       3.20         927A,B
 IT1W                 9          1           0       0.00           0       9.00         929A,B
 SC2W                 9          1           0       0.00           0       9.00         933A,B
 IT2V                13          5           0       0.00           0       2.60         937A,B
 IT2W                17          6           0       0.00           0       2.83         941A,B
 TS1V                 9          1           0       0.00           0       9.00         945A,B
 SC2V                12          5           0       0.00           0       2.40         947A,B
 TS1W                11          1           0       0.00           0      11.00         949A,B
 PS3V                13          3           0       0.00           0       4.33         953A,B
 IT1U                 9          6           0       0.00           0       1.50         957A,B
 SC4U                11          5           0       0.00           0       2.20         962A,B
 SC6W                10          1           0       0.00           0      10.00         966A,B
 PS2V                 8          6           0       0.00           0       1.33         970A,B
 IT8X                12          1           0       0.00           0      12.00         974A,B
 SC4W                10          1           0       0.00           0      10.00         978A,B
 SC6U                14          6           0       0.00           0       2.33         982A,B
 IT2Y                 9          3           0       0.00           0       3.00         986A,B
 SC2X                15          1           0       0.00           0      15.00         990A,B
 PS2Y                17          2           0       0.00           0       8.50         994A,B
 SC4Y               152          4           0       0.50           1      38.00         998A,B
 SC2Y               106          2           0       0.00           0      53.00        1000A,B
 IT2X                20          1           0       0.00           0      20.00        1004A,B
 SC2U                15          3           0       0.00           0       5.00        1008A,B
 SC4Z               123          5           0       0.60           1      24.60        1010A,B
 TS1X                15          1           0       0.00           0      15.00        1015A,B
 SC4X                19          1           0       0.00           0      19.00        1019A,B
 PS2X                13          1           0       0.00           0      13.00        1024A,B
 PS2Z                20          5           0       0.00           0       4.00        1028A,B
 SC6Z               130          1           0       0.00           0     130.00        1031A,B
 SC6V                10          4           0       0.00           0       2.50        1035A,B
 SC6Y               143          1           0       0.00           0     143.00        1037A,B
 IT1X                10          1           0       0.00           0      10.00        1040A,B
 PS3U                19          6           0       0.00           0       3.16        1131A,B
 IT2U                13          4           0       0.00           0       3.25        1146A,B
```

Figure 166. Transaction Queuing Report

Monitoring Database Buffers

One of the key resources in an online system is the database buffer pool. The efficiency of DL/I call service depends on the presence of the required database logical record in the buffer, so that segment retrieval does not require additional I/O. This is especially true for HOLD calls with intervening database calls prior to a replace call. You can assess the general efficiency of the pool management using the Database Buffer Pool report shown in Figure 167 on page 434. The event counts on this report are not specific to a particular database or program but represent the pressure for use of the database pool.

Related Reading: Refer to *IMS Version 9: Utilities Reference: Database and Transaction Manager* for more information on the Database Buffer Pool reports.

```
                D A T A   B A S E   B U F F E R   P O O L

                                                        FIX PREFIX/BUFFERS              Y/Y
                                                        SUBPOOL ID                     004K
                                                        SUBPOOL BUFFER SIZE            4096
                                                        TOTAL BUFFERS IN SUBPOOL       1000

                                                    16:09:59          16:25:10
                                                   START TRACE       END   TRACE       DIFFERENCE

    NUMBER OF LOCATE-TYPE CALLS                      407636            4296793           3889157
    NUMBER OF REQUESTS TO CREATE NEW BLOCKS               1                  7                 6
    NUMBER OF BUFFER ALTER CALLS                      75006             819359            744353
    NUMBER OF PURGE CALLS                              9137              93881             84744
    NUMBER OF LOCATE-TYPE CALLS, DATA ALREADY IN OSAM POOL  313896       3317264           3003368
    NUMBER OF BUFFERS SEARCHED BY ALL LOCATE-TYPE CALLS  453364         4779327           4325963
    NUMBER OF READ I/O REQUESTS                        86881             904487            817606
    NUMBER OF SINGLE BLOCK WRITES BY BUFFER STEAL ROUTINE      0              0                 0
    NUMBER OF BLOCKS WRITTEN BY PURGE                  32629             360434            327805
    NUMBER OF LOCATE CALLS WAITED DUE TO BUSY ID         281               3173              2892
    NUMBER OF LOCATE CALLS WAITED DUE TO BUFFER BUSY WRT   6               180               174
    NUMBER OF LOCATE CALLS WAITED DUE TO BUFFER BUSY READ  0                 0                 0
    NUMBER OF BUFFER STEAL/PURGE WAITED FOR OWNERSHIP RLSE  43             483               440
    NUMBER OF BUFFER STEAL REQUESTS WAITED FOR BUFFERS     0                 0                 0
    TOTAL NUMBER OF I/O ERRORS FOR THIS SUBPOOL            0                 0                 0
    NUMBER OF BUFFERS LOCKED DUE TO WRITE ERRORS           0                 0                 0

    QUOTIENT :  TOTAL NUMBER OF OSAM READS + OSAM WRITES =          7.02
                ____________________________________________
                        TOTAL NUMBER OF TRANSACTIONS
```

Figure 167. Database Buffer Pool Report

If any of your databases use VSAM as access method, the IMS Monitor produces a series of reports headed VSAM BUFFER POOL, one for each subpool. Figure 168 shows one of these reports.

```
***I M S   M O N I T O R***  BUFFER POOL STATISTICS

                V S A M   B U F F E R   P O O L

                                                        FIX INDEX/BLOCK/DATA          N/Y/N
                                                        SHARED RESOURCE POOL ID       VPL1
                                                        SHARED RESOURCE POOL TYPE        D
                                                        SUBPOOL ID                       2
                                                        SUBPOOL BUFFER SIZE           4096
                                                        NUMBER HIPERSPACE BUFFERS        0
                                                        TOTAL BUFFERS IN SUBPOOL         4

                                                    16:09:59          16:25:10
                                                   START TRACE       END   TRACE       DIFFERENCE

    NUMBER OF RETRIEVE BY RBA CALLS RECEIVED BY BUF HNDLR   432          6029              5597
    NUMBER OF RETRIEVE BY KEY CALLS                   40857             443840            402983
    NUMBER OF LOGICAL RECORDS INSERTED INTO ESDS        414               6011              5597
    NUMBER OF LOGICAL RECORDS INSERTED INTO KSDS       2132              25266             23134
    NUMBER OF LOGICAL RECORDS ALTERED IN THIS SUBPOOL     0                 0                 0
    NUMBER OF TIMES BACKGROUND WRITE FUNCTION INVOKED     0                 0                 0
    NUMBER OF SYNCHRONIZATION CALLS RECEIVED           6494              70963             64469
    NUMBER OF WRITE ERROR BUFFERS CURRENTLY IN THE SUBPOOL  0               0                 0
    LARGEST NUMBER OF WRITE ERRORS IN THE SUBPOOL         0                 0                 0
    NUMBER OF VSAM GET CALLS ISSUED                   44249             487181            442932
    NUMBER OF VSAM SCHBFR CALLS ISSUED                    0                 0                 0
    NUMBER OF TIMES CTRL INTERVAL REQUESTED ALREADY IN POOL  11886      129668            117782
    NUMBER OF CRTL INTERVALS READ FROM EXTERNAL STORAGE  32842          363635            330793
    NUMBER OF VSAM WRITES INITIATED BY IMS              2370              29208             26838
    NUMBER OF VSAM WRITES TO MAKE SPACE IN THE POOL       0                 0                 0
    NUMBER OF VSAM READS FROM HIPERSPACE BUFFERS          0                 0                 0
    NUMBER OF VSAM WRITES FROM HIPERSPACE BUFFERS         0                 0                 0
    NUMBER OF FAILED VSAM READS FROM HIPERSPACE BUFFERS   0                 0                 0
    NUMBER OF FAILED VSAM WRITES FROM HIPERSPACE BUFFERS  0                 0                 0

    QUOTIENT :  TOTAL NUMBER OF VSAM READS + VSAM WRITES =          2.19
                ____________________________________________
                        TOTAL NUMBER OF TRANSACTIONS
```

Figure 168. VSAM Buffer Pool Report

IMS Internal Resource Usage

There are several summary reports that you can use to examine the level of internal contention for resources. The following sections give a brief description of these reports.

Pool Space Failure

The Pool Space Failure Summary report gives the number of times (in each region) a given amount of storage was unavailable. It shows the number of bytes, the identification of the pool, and the number of occurrences when storage was unavailable. You can use this summary to determine if you need to increase the buffer pool allocation, either by a system definition change or by overriding the number of buffers in the EXEC statements in the JCL.

The format of the report is shown in Figure 169.

```
POOL SPACE FAILURE SUMMARY

          POOL ID    BYTES REQ.   OCCURRENCES
          DLMP           8888           1
          DLDP           7777           1
     TOTAL                               2
```

Figure 169. Pool Space Failure Report

Programs Experiencing Deadlock

The Deadlock Event Summary report records each time a pair of programs reaches a deadlock over ownership of a segment in a given database data set. Each line in the report shows the two PSBs involved and indicates which is given processing right-of-way (REQ-ING PSB) and which has to reprocess after dynamic backout has occurred (LOSING PSB). The report is illustrated in Figure 170.

```
DEADLOCK EVENT SUMMARY

     REQ-ING PSB    LOSING PSB    DMBNAME    OCCURRENCES
     PSBNAME1       TPPSBRE3      DBASEBAL       1
  TOTAL                                          1
```

Figure 170. Deadlock Event Summary Report

IMS Latch Conflict

The basic serialization of the task processing in IMS is controlled by ownership of an IMS latch. When different programs are executing, they compete for the ownership. If they wait for the resource, the one possessing the latch has to post the other ITASK waiting for it. Use the Latch Conflict Statistics report to judge the level of contention for a resource.

The different types of latches and the counters that exhibit the level of contention are given in the Latch Conflict Statistics report. Figure 171 on page 436 is an example of this report. The entries are organized according to the latch names.

For the latch names and abbreviations of the different types of resources being serialized see “IMS Latch Conflict” on page 407.

When a system checkpoint is taken during the time the monitor is active, latch conflict statistics are reset to zero, thus corrupting the values presented in this report. If this situation exists, the following message will be inserted at the top of the report:

```
**** A CHECKPOINT OCCURRED DURING MONITOR RUN ****
****  LATCH CONFLICT STATISTICS ARE INVALID   ****
****      SEE UTILITIES REFERENCE MANUAL      ****
```

However, if the master terminal operator issues the /CHECKPOINT command with the STATISTICS keyword parameter, latch conflict statistics are reset to zero, but the IMS monitor is not notified. Therefore, DFSUTR20 cannot detect that the statistics have been corrupted and will not issue this message.

Recommendation: Do not issue statistics checkpoints while the monitor is running.

```
        IMS MONITOR   ** GENERAL REPORTS **          TRACE START 1993 209...

                LATCH CONFLICT STATISTICS

LATCH       COUNT                 AT          AT
NAMES       FIELD           START         END        DIFF.

LOGL     CONTENTIONS              0           0           0

SMGT     CONTENTIONS              0           0           0

XCNQ     CONTENTIONS              0           0           0

ACTL     CONTENTIONS              0           0           0


CBTS     CONTENTIONS              0           0           0

DBLK     CONTENTIONS              0           0           0
```

Figure 171. Latch Conflict Statistics Report

Using Frequency Distributions from IMS Monitor Output

The reports derived from the IMS Monitor data records contain many summary lines where the mean time is given. If you are interested in the distribution of those timed events, rather than just average and maximum times, you can request the Report Print utility to individually record the events in a frequency distribution across a range of intervals. Some distributions are not time dependent, such as those for transaction queue loads or transmitted block sizes.

How to Get a Frequency Distribution Output

To request the IMS Monitor Report Print utility to gather distribution data, you must include a DIS input control statement. This causes all report items with an entry under a column headed MEAN to have a corresponding frequency distribution as part of the Distribution Appendix. Also, each report line includes an identifying reference number under the column headed DISTRIBUTION NUMBER so that you can locate the distribution data in the appendix, flagged by that same number.

The following tables show the major IMS Monitor reports and the type of frequency distributions generated for each report. Each type results in several distributions, depending on how many entries are in each section of the report. For each type of frequency distribution, the data is cumulated in suitable intervals or ranges. The set

of ranges used for each type is given an identifier, shown in the ID column. Table 39 shows the report distributions sorted by Region Summary.

Table 39. Report Distributions by Region Summary

Report Name	ID	Description
Scheduling and Termination	D1	Elapsed time
	D2	Not wait time
Schedule end to 1st DL/I call	D3	N/A
Elapsed execution time	D4	N/A
DL/I calls	D5	Elapsed time
	D6	Not wait time
External Subsystem calls	D43	Elapsed time
Waits per DL/I call	D7	N/A
Idle for intent	D8	N/A
Checkpoint	D20	Elapsed time
	D21	Not wait time

Table 40 shows the report distributions sorted by Programs Region.

Table 40. Report Distributions by Programs Region

Report Name	ID	Description
Elapsed execution time	D30	N/A
Schedule and to 1st DL/I call	D31	N/A

Table 41 shows the report distributions by Program Summary.

Table 41. Report Distributions by Program Summary

Report Name	ID	Description
Processor time per schedule	D15	N/A
Transactions dequeued per schedule	D14	N/A
Elapsed time per schedule	D9	N/A
Schedule end to 1st DL/I call	D10	N/A

Table 42 shows the report distributions sorted by Call Summary.

Table 42. Report Distributions by Call Summary

Report Name	ID	Description
PSB waits per DL/I call	D13	N/A
PSB waits per external subsystem call	D44	N/A
PSB elapsed time per call	D11	N/A
PSB not wait time per call	D12	N/A
PSB external subsystem calls	D45	N/A
	N/A	Elapsed time

Table 43 lists some distributions derived from buffer pool statistics for wait times.

Table 43. Wait Time Distributions

Function	ID	Module Key
Storage	D22	SMN
OSAM I/O	D23	DBH
VSAM I/O	D24	VBH
Block loader I/O	D27	BLR
HSAM I/O	D34	DIE
PI enqueue	D40	None

How Frequency Distribution Ranges Are Defined

A set of ten intervals is defined for each summary line and the occurrences falling in each interval are cumulated. The interval ranges are preset with default end points. For example, the end points, for DL/I call elapsed time are: 0, 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, INF (all times are in milliseconds). The default end points are chosen so that they are suitable to the event. The lower limit of the first interval always defaults to zero, and the upper limit of the tenth interval is infinity (INF).

Although several types of distribution can use the same set of end points, each type is assigned a distribution identifier. You can use this to redefine the end points. To override the default end points include an input control statement to the Report Print utility. The statement specifies the type of distribution identifier and gives the desired end point values. For example, the DL/I call elapsed time end points could be respecified by:

```
D5   0,500,1000,1500,2000,4000,,,100000,500000
```

The values of the unspecified end points remain at their default values of 32000 and 64000 as does the last (INF).

Figure 172 on page 439, which is a sample page taken from a Distribution Appendix, shows how individual distributions are numbered and how ranges vary with the type of distribution. The lines are arranged in pairs, with the second one recording the cumulated counts.

```
     IMS MONITOR   ****DISTRIBUTION APPENDIX****       TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0200

#    1..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#    2..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#    3..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#    4..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#    5..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          6
#    6..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          8
#    7..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#    8..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          9
#    9..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#   10..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 1          0          0          0          0          0          0          0          0          7
#   11..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#   12..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          8
#   13..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#   14..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
#   15..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 1          0          0          0          0          0          0          0          0          8
#   16..........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                 0          0          0          0          0          0          0          0          0          1
```

Figure 172. Distribution Appendix Report

Default Values of Distribution Definitions

Using an identifier provided in the frequency distribution tables (Table 39 on page 437 through Table 42 on page 437) and the Wait Time Distributions table (Table 43 on page 438) you can determine the default end points for the distribution by locating it in the following list:

D1, D2, D5, D6, D9, D10, D11, D12, D15 D18, D19, D20, D21, D22, D25, D27 D28, D29, D30, D31, D43, and D45
0, 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, INF

D3
0, 50000, 100000, 150000, 200000, 250000, 300000, 350000, 400000, 450000, INF

D4
0, 200000, 400000, 600000, 800000, 1000000, 1200000, 1400000, 1600000, 1800000, INF

D7, D13, and D44
0, 0, 1, 2, 3, 4, 5, 6, 7, 8, INF

D8
0, 100000, 200000, 300000, 400000, 500000, 600000, 700000, 800000, 900000, INF

D14, D16, D17
0, 1, 2, 3, 4, 5, 10, 15, 30, 90, INF

D23, D24, D26, D32, D40, D42
0, 2000, 8000, 24000, 50000, 100000, 150000, 200000, 250000, 300000, INF

D33, D34, D35
0, 2000, 4000, 8000, 16000, 32000, 64000, 96000, 128000, 160000, INF

D36, D37	0, 10, 20, 40, 80, 100, 200, 400, 800, 1000, INF
D38	0, 1000, 10000, 100000, 200000, 500000, 800000, 1000000, 1500000, 2000000, INF
D39	0, 1000, 5000, 10000, 50000, 100000, 500000, 1000000, 5000000, 10000000, INF

Interpreting Distribution Appendix Output

You can use the detailed output in the Distribution Appendix when you suspect an unusual combination of events was reported in a report summary line. Usually, the average and maximum times or counts are sufficient to highlight a resource usage problem. However, if you suspect the mean value to be masking an unusual distribution you can draw on the detail contained in the IMS Monitor output records.

Chapter 20. Interpreting IMS Monitor Reports for DCCTL

DCCTL is a transaction management subsystem that has no database components. With the external subsystem (ESS) attach facility, it provides the transaction management capability for non-IMS database subsystems.

This chapter describes:

- The events that the IMS Monitor collects
- The content of the reports produced by the IMS Monitor Report Print Program in a DCCTL environment

DCCTL does not change the format or usage of the IMS Monitor reports. There are reports, and fields within reports, that contain information specific to databases, and these are not applicable to the DCCTL environment. Reports that do not apply to DCCTL appear as a heading without data, or are not produced. The reports that do not apply to DCCTL include:

- Database Buffer Pool report
- VSAM Buffer Pool (DB) report
- Call Summary (DB) report
- Program I/O (DB) report

For a detailed look at the events, system activities, and use of storage areas (buffer pool or data set) for which timings are gathered by the IMS Monitor, see Table 27 on page 381.

The following topics provide additional information:

IMS Monitor Trace Event Intervals

The IMS Monitor trace interval is defined by the master terminal operator's use of the /TRACE command between the start and stop command entries. The online IMS events are recorded in IMS Monitor records placed in the IMSMON data set. The event timings are related to dependent region activity. Figure 173 on page 442 shows the boundaries of the timed event intervals.

The Monitor trace interval includes the following intervals:

- Scheduling and Termination
  - Block loader busy
  - Schedule failures (PSB busy and space failure)
  - Sched/Term elapsed
    - NOT-WAIT
    - ACBLIB waits
- Region occupancy (which overlaps with all of Sched/Term elapsed)
  - Schedule to first call
  - Elapsed execution

The NOT-WAIT time for a region is the elapsed time not accounted for by wait time. Any delay coming from either paging or the processor being dispatched for a higher priority task results in an increase in the NOT-WAIT times.

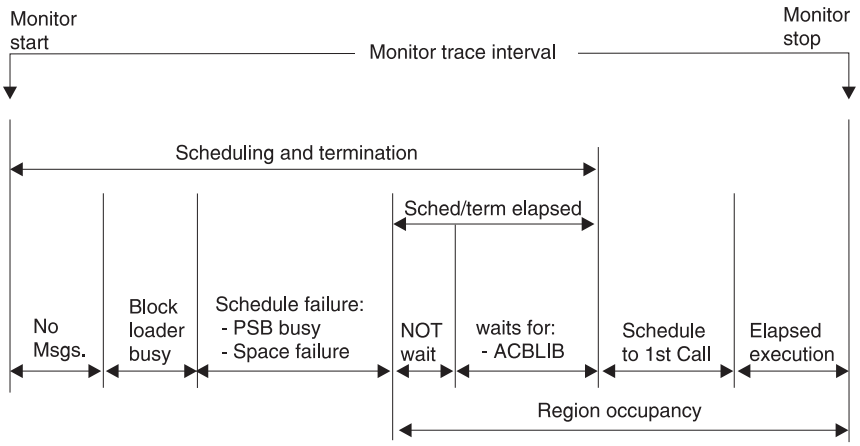


Figure 173. IMS Monitor Trace Event Intervals

Overview of IMS Monitor Reports

A list of reports available from data collected by the IMS Monitor, together with the principal performance data they contain, is shown in Table 44. The reports marked “MSC” in the list are only produced when MSC is active. The MSC reports are discussed in “Interpreting IMS Monitor MSC Reports” on page 468.

Sequence of Report Output

The order of the reports listed in Table 44 matches the sequence of the output from the IMS Monitor Report Print Program. The duration of a monitoring snapshot might not include certain events necessary for an individual report, in which case only report headings or partial data are produced.

Summary of IMS Monitor Reports in Output Sequence

Table 44. Output Sequence and Information from IMS Monitor Reports

Report Name	Principal Information
System Configuration	Monitor run documentation
Message Queue Pool	Buffering and message I/O per transaction
Message Format Buffer Pool	Count of I/Os

Table 44. Output Sequence and Information from IMS Monitor Reports (continued)

Report Name	Principal Information
Latch Conflict Statistics	IMS internal processing
General Wait Time Events	Wait times for SNAPQ
Region and Jobname	Monitor run documentation
Region Summary	Elapsed times and count of DL/I calls (DC)
Region Wait	Wait times
Programs by Region	Elapsed times for region usage
Program Summary	Overall program statistics
Communication Summary	Elapsed times for lines
Communication Wait	Wait times by line
Line Functions	Count and size of blocks transmitted
MSC Traffic (MSC)	Count and routing of transactions
MSC Summaries (MSC)	Count of transactions by destination
MSC Queuing Summary (MSC)	Count and queuing time by link
Transaction Queuing	Queue loading statistics
Reports	Count of space failures and deadlocks
Run Profile	Monitor run documentation
Distribution Appendix	Event frequency distributions

Units of Measure in IMS Monitor Reports

The majority of the data items in IMS Monitor reports are elapsed times. These are normally expressed in microseconds. An entry of 1876534 is 1.876534 seconds or 1876 milliseconds. Any times that do not follow this convention show the unit of measure on the report.

You can also find counts of events under the heading `OCCURRENCES`, and figures that represent the number of bytes.

Documenting the Monitoring Run

For each trace interval there are several general reports or overall summaries of the processing that took place. You can use these reports as part of your IMS Monitor run documentation.

It is important to record as accurately as possible the conditions under which the trace was taken. Your documentation can include system status information obtained by the `/DISPLAY` command several times before and after the trace, an expected profile of the application program activity, and any desired processing events. The trace interval should represent typical processing loads and not be a biased or inadequate historical record.

Adding to the System Configuration Report Data

The first general report titled `SYSTEM CONFIGURATION` is found under the page heading `BUFFER POOL STATISTICS`. It shows the modification level of the IMS and z/OS systems. You can add a list of IMS APARs applied and include the service

levels of the application programs, especially if the latter are not permanent programs or are part of a staged implementation. The system configuration output is illustrated in Figure 174.

Recording the Monitor Trace Interval

The heading of most IMS Monitor reports carries the trace start and stop times. It is shown in the format YEAR DAY (Julian) HH:MM:SS. The overall length of the trace interval is given in seconds under the heading TRACE ELAPSED TIME IN SECONDS. The following line shows how many trace records were placed on the IMS.MON data set. An example of the monitor trace interval recording is shown in Figure 174.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0001

                S Y S T E M  C O N F I G U R A T I O N


                                          SYSTEM CONFIGURATION      :
                                             IMS VERSION            :   4
                                          RELEASE LEVEL             :
                                          MODIFICATION NUMBER       :
```

Figure 174. IMS Monitor System Configuration Report and Trace Interval

Completing the Monitor Run Profile

A compact set of processing ratios is found at the end of the Run Profile report. The statistics summarize, for the monitor interval, the transaction throughput and the degree of DL/I and I/O activity. An example of the report is shown in Figure 175 on page 445. In a DCCTL environment, DL/I activity is restricted to data communications calls and calls to GSAM databases. Database calls to other types of DL/I databases are not supported in DCCTL.

The lower part of the Run Profile report shows several ratios:

- Program elapsed time to DL/I elapsed time for each region
- DL/I elapsed time to wait time during DL/I processing
- Program elapsed time to other subsystem call elapsed time
- DL/I elapsed time to other subsystem call elapsed time

Each dependent region is identified by a sequence number, starting at region 1.

```
     IMS MONITOR   **RUN PROFILE**                    TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0184
TRACE ELAPSED TIME IN SECONDS.......274.6
TOTAL NUMBER OF MESSAGES DEQUEUED....1403
TOTAL NUMBER OF SCHEDULES        .....173
NUMBER OF TRANSACTIONS PER SECOND    5.1
TOTAL NUMBER OF DL/I CALLS ISSUED....18632
NUMBER OF DL/I CALLS PER TRANSACTION   13.2
NUMBER OF OSAM BUFFER POOL I/O'S.           0,    0.0 PER TRANSACTION
NUMBER OF MESSAGE QUEUE POOL I/O'S.........0,    0.0 PER TRANSACTION
NUMBER OF FORMAT BUFFER POOL I/O'S.........0,    0.0 PER TRANSACTION
RATIO OF PROGRAM ELAPSED TO DL/I ELAPSED:
               REGION   1:   1.09
               REGION   2:   1.09
               REGION   3:   1.00
               REGION   4:   1.02
               REGION   5:   1.01
               REGION   6:   1.00
               REGION   7:   1.00
               REGION   8:   1.00
               REGION   9:   1.17
               REGION  10:   1.00
               REGION  11:   1.00
               REGION  49:   1.03
               REGION  50:   1.19
RATIO OF DL/I ELAPSED TO DL/I IWAIT:
               REGION   1: 325.65
               REGION   2:  73.49
               REGION   4: 100.35
               REGION   5:  85.76
               REGION   6:  82.99
               REGION  47:  95.64
               REGION  48:  45.93
               REGION  49:   9.22
```

Figure 175. Run Profile Report

You can match the regions to the z/OS job name using the Region and Jobname report. The job names correspond to the step names on the EXEC statements of all the dependent regions started by the operator before the trace was started. The region job names are included on the monitor output page with the heading `GENERAL REPORTS`, as illustrated in Figure 185 on page 459.

There are some generalized processing ratios that are given at the end of several buffer pool statistics reports. You can include them in the documented profile of the trace interval. These are not specific to one application or system resource but can be used as indicators of variation across a series of monitor runs. In DCCTL, the ratios are:

- All waits divided by the total number of transactions

  This value can be found on the Message Queue Pool Report in Figure 184 on page 458. This ratio indicates on a per transaction basis the physical I/O activity required to handle the message queuing function.
- The total prefetch I/Os + immediate fetch I/Os + directory I/Os divided by the total number of transactions

  This value also appears on Figure 183 on page 458. This ratio indicates on a per transaction basis the physical I/O activity required to handle the MFS function during the trace period.

Verifying IMS Monitor Report Occurrences

When you examine the output from the IMS Monitor Report Print program, do not assume that the presence of a report heading implies that appropriate data is listed. System definition options and utility control statements affect the content of the output as follows:

- The output does not include a Call Summary report unless a control statement specifies `DLI`.

- The output does not include a set of Distribution reports unless a control statement specifies DIS or DISTRIBUTION. The column headed DISTRIBUTION NUMBER that occurs on many of the reports contains cross-references to items included in the Distribution reports.
- The output consists of just a Call Summary report if a control statement specifies ONLY DLI.

Because many of the summary reports require system status to calculate the difference between start and end values, and this status is obtained during /TRACE SET OFF processing, the IMS Monitor execution must end before termination of the IMS control region. If the trace was not stopped properly, the following message is issued:

```
NO QUEUE BUFFER POOL TRACES AT END TIME ON MONITOR LOG TAPE
****QUEUE BUFFER POOL REPORT CANCELLED****
```

Similarly, other summary reports are not produced.

The section MESSAGE FORMAT BUFFER POOL is included only if your system definition specifies devices using Message Format Service.

If the source data used to formulate a particular IMS Monitor report, or a section of that report, has not been recorded by the IMS Monitor during the trace interval, the report contains only the headings.

Monitoring Activity in Dependent Regions

The IMS Monitor gathers timing information for every dependent region identified in the /trace command active during the trace interval. It records the total of the elapsed times for each event, the time for the longest event encountered, and the average time for all recorded events.

There are three major reports that display timings. The reports and a list of their content are:

- **Region Summary Report**
  - Scheduling and termination
  - Schedule end to first call
  - Elapsed execution with separate summaries shown for:
    - DL/I calls
    - External subsystem service and command calls
    - External subsystem database access calls
    - Checkpoint processing
    - Region occupancy
- **Region Wait**
  - Waits during scheduling and termination
  - Waits during DL/I calls
  - Waits during external subsystem calls
  - Waits during checkpoint
- **Programs by Region**
  - Elapsed execution
  - Schedule end to first call

These three reports are illustrated in Figure 176 on page 448, Figure 177 on page 449, and Figure 178 on page 450.

Activities in dependent regions are placed in five timing categories:

- Elapsed time for scheduling and termination

  The scheduling process includes many preparatory events such as block loading from an active IMS.ACBLIBA/B data set and obtaining ownership of the PSB. The time required to terminate the region activity after the application program ends is also included.
- Elapsed time from end of schedule to first call

  This time is reserved for application program initialization and housekeeping prior to an initial call (to the message queue, or an external subsystem) that marks the beginning of control program services. It is a measure of processing that is not repeated when multiple transactions are processed in a single scheduling.
- Program elapsed time, including all calls

  This time encompasses the major application program processing and is measured from the first call to the return to or exit from the program.
- Elapsed time performing DL/I calls

  This time includes all DL/I calls. Each DL/I call event is measured from the time of the call to the return to the application program.
- Elapsed time performing external subsystem calls

  This time includes all external subsystem calls. Each external subsystem event is measured from the time of the call to the return to IMS.

```
     IMS MONITOR   ****REGION SUMMARY****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0011
                                              (A)                                  (B)
                                   .........ELAPSED TIME.........       NOT IWAIT TIME(ELAPSED-IWAIT)                DISTRIBUTION
                OCCURRENCES        TOTAL        MEAN     MAXIMUM        TOTAL        MEAN     MAXIMUM                   NUMBER
                ___________        _____        ____     _______        _____        ____     _______                   ______
SCHEDULING AND TERMINATION
_________ ___ ___________
**REGION     5           5         4146         829         948         4146         829         948                    287A,B
**REGION     6           7         6028         861        1067         6028         861        1067                    214A,B
**REGION     8           8         6847         855        1098         6847         855        1098                    129A,B
**REGION    10           7         9664        1380        3668         9664        1380        3668                    272A,B
**REGION    47           6         5482         913        1021         5482         913        1021                    145A,B
**REGION    49           3         2612         870         917         2612         870         917                    443A,B
**TOTALS               123       126042        1024                    126042        1024
SCHEDULE TO FIRST CALL
________ __ _____ ____
**REGION     1           1     15479797    15479797    15479797                                                        555
**REGION     2           1     22376350    22376350    22376350                                                        564
**REGION     3           1     15169488    15169488    15169488                                                        578
**REGION     4           1     48146258    48146258    48146258                                                        584
**REGION    48           1       795351      795351      795351                                                        592
**REGION    49           4      2960425      740106     2951746                                                        442
**REGION    50           1     15713464    15713464    15713464                                                        575
**TOTALS               168    514286738     3061230
ELAPSED EXECUTION
_______ _________
**REGION     1           1    290146255   290146255   290146255                                                          1
**REGION     2           1    252290108   252290108   252290108                                                          2
**REGION     3           1    259496970   259496970   259496970                                                          3
**REGION     4           1    322812716   322812716   322812716                                                          4
**REGION    48           1    273871107   273871107   273871107                                                         48
**REGION    49           4    271703421    67925855   155176058                                                         49
**REGION    50           1    290379922   290379922   290379922                                                         50
**TOTALS               173  14238540145    82303700
DL/I CALLS                                                                                                  IWT/CALL(C)
____ _____                                                                                                  _________
**REGION     1          60    264626241     4410437    88981490   263813671     4396894    88970053          0.76      247A,B,C
**REGION     2         223    230505269     1033655    61048758   227368742     1019590    61011153          0.73      237A,B,C
**REGION     3          29    257704383     8886358    69000514   257704383     8886358    69000514          0.00       98A,B,C
**REGION     4         792    313735347      396130    52439653   310609035      392183    52439653          0.22      180A,B,C
**REGION    49         592    262886317      444064    30202068   234394017      395935    30159782          2.46      177A,B,C
**REGION    50          36    242591451     6738651    48651260   242591451     6738651    48651260          0.00      289A,B,C
**TOTALS             18632  12386905286      664818            12024562411      645371                      0.97
IDLE FOR INTENT
____ ___ ______
                      NONE
CHECKPOINT
__________
                      NONE
REGION OCCUPANCY
______ _________
**REGION     1    100.0%
**REGION     2    100.0%
**REGION     3    100.0%
**REGION     4    100.0%
**REGION    48    100.0%
**REGION    49    100.0%
**REGION    50    100.0%
```

Figure 176. Region Summary Report

```
     IMS MONITOR   ****REGION IWAIT****               TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0023
                                .........IWAIT TIME.........                                DISTRIBUTION
**REGION     5 OCCURRENCES       TOTAL        MEAN     MAXIMUM       FUNCTION  MODULE       NUMBER
  ______      ___________       _____        ____     _______       ________  ______       ______
SCHEDULING + TERMINATION
_________  ___________
   SUB-TOTAL
   _________
   TOTAL
   _____
DL/I CALLS
____ _____
                      11      181816       16528       24375    DD=IMMSTR2A   DBH            117
                       8      112831       14103       17846    DD=IMMSTR1A   DBH            118
                       5       85460       17092       33717    DD=IMMSTR3A   DBH            119
                       5       58420       11684       14643    DD=IMINDEXA   VBH            120
                      12      173866       14488       22152    DD=PRODCNTA   VBH            121
                       3      100576       33525       68373    DD=IMMSTR2B   DBH            428
                       1       17921       17921       17921    DD=IMMSTR3B   DBH            429
                       1       17195       17195       17195    DD=IMMSTR1B   DBH            430
                       1       13577       13577       13577    DD=IMINDEXB   VBH            431
                       3       49928       16642       20396    DD=PRODCNTB   VBH            432
                       4       10973        2743        2787    DD=ITEMACTB   DBH            453
                       2       37680       18840       27664    DD=IAINDEXB   VBH            454
                      49     1500067       30613      138284    DD=INVENTRA   DBH            472
                      23      345595       15025       27613    DD=VENDORDA   VBH            473
                       1      342952      342952      342952    PI=VENDORDA...1              498
                       1       14612       14612       14612    PI=VNSINDXA...1              499
                       6       69203       11533       19492    DD=VNSINDXA   VBH            500
   TOTAL
   _____             136     3132672       23034
```

Figure 177. Region Wait Report

```
     IMS MONITOR   ****PROGRAMS BY REGION****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0069
                                                (A)                                (B)
                                  ELAPSED EXECUTION TIME            SCHEDULING END TO FIRST CALL      DISTRIBUTION
                OCCURRENCES       TOTAL        MEAN     MAXIMUM       TOTAL        MEAN     MAXIMUM       NUMBER
                ___________       _____        ____     _______       _____        ____     _______       ______
**REGION     1
________ _ 1
    PROGSC6D            1   290146255   290146255   290146255    15479797    15479797    15479797         885A,B
 REGION TOTALS          1   290146255   290146255                15479797    15479797
**REGION     2
________ _ 2
    PROGIT8C            1   252290108   252290108   252290108    22376350    22376350    22376350         889A,B
 REGION TOTALS          1   252290108   252290108                22376350    22376350
**REGION     3
________ _ 3
    PROGTS1C            1   259496970   259496970   259496970    15169488    15169488    15169488         893A,B
 REGION TOTALS          1   259496970   259496970                15169488    15169488
**REGION     4
________ _ 4
    PROGPS3D            1   322812716   322812716   322812716    48146258    48146258    48146258         897A,B
 REGION TOTALS          1   322812716   322812716                48146258    48146258
**REGION     5
________ _ 5
    PROGPS3A            2    62893103    31446551    40693590        5435        2717        2862         901A,B
    PROGTS1B            1    61794787    61794787    61794787        2790        2790        2790        1271A,B
    PROGPS3B            1    18294458    18294458    18294458        3104        3104        3104        1350A,B
    PROGIT2B            1    36095342    36095342    36095342        2731        2731        2731        1363A,B
    PROGSC2A            1    93902771    93902771    93902771     1667791     1667791     1667791        1401A,B
 REGION TOTALS          6   272980461    45496743                 1681851      280308
**REGION     6
________ _ 6
    PROGIT1B            2    39000315    19500157    23703429        5286        2643        2801         905A,B
    PROGTS1B            1    34293636    34293636    34293636        3136        3136        3136        1207A,B
    PROGPS3A            1    51887767    51887767    51887767        2534        2534        2534        1278A,B
    PROGPS3B            2    67375031    33687515    40291430    17210570     8605285    17213287        1328A,B
    PROGIT8A            1    69132416    69132416    69132416        3291        3291        3291        1359A,B
    PROGSC4A            1    30165017    30165017    30165017        2571        2571        2571        1433A,B
 REGION TOTALS          8   291854182    36481772                17193752     2149219
**REGION     7
________ _ 7
    PROGSC2B            1   269618583   269618583   269618583     5047875     5047875     5047875         909A,B
 REGION TOTALS          1   269618583   269618583                 5047875     5047875
**REGION     8
________ _ 8
    PROGIT8A            1     5181039     5181039     5181039        2928        2928        2928         913A,B
    PROGPS3A            1    27304257    27304257    27304257        3350        3350        3350        1132A,B
    PROGSC4B            1    37286872    37286872    37286872        3009        3009        3009        1255A,B
    PROGIT2A            1    36902995    36902995    36902995        2850        2850        2850        1298A,B
    PROGIT1B            1    30407479    30407479    30407479        2565        2565        2565        1336A,B
    PROGIT1A            3   109875360    36625120    45190114     4279008     1426336     4272096        1357A,B
    PROGIT8B            1    23405220    23405220    23405220        2679        2679        2679        1395A,B
 REGION TOTALS          9   270363222    30040358                 4296389      477376
```

Figure 178. Programs-by-Region Report

Examining the Effects of Checkpoints

The checkpoint line of the Region Summary report at the end of the region 0 summary shows the following:

- The number of system checkpoint taken during the monitor interval
- The elapsed times
- The not-wait times

Checkpoint processing can be initiated by the control program at a specified frequency determined by the number of records placed on the system log. Other checkpoints can be caused by operator commands.

The wait time experienced during checkpoints is reported at the end of the first region summary on the Region Wait report. You can detect delays for each combination of DD name and module code. Typical entries here are for the

message queue data sets and the restart data set. If an wait for storage is the cause, the entry under the FUNCTION column is STG.=, followed by the identification of the pool.

Measuring Region Occupancy

A measure of region activity is the percentage of region occupancy. This is broadly the ratio of the elapsed time a region is performing processing to the trace interval. The region occupancy time does not include those times when no messages are available, when the block loading is delayed, or when the PSB cannot be used. The last section in the Region Summary report lists all active regions for which timed events were collected and shows the calculated percentage region occupancies.

Monitoring Application Program Elapsed Time

The IMS Monitor can record measurements of elapsed times for each transaction and scheduling of an application program. It does this during the monitored interval while other programs are executing concurrently. Elapsed times are calculated from the start of the first DL/I (or other) call to the end of that program. You can distinguish between time spent in application code and in DL/I processing. The event intervals are illustrated in Figure 179:

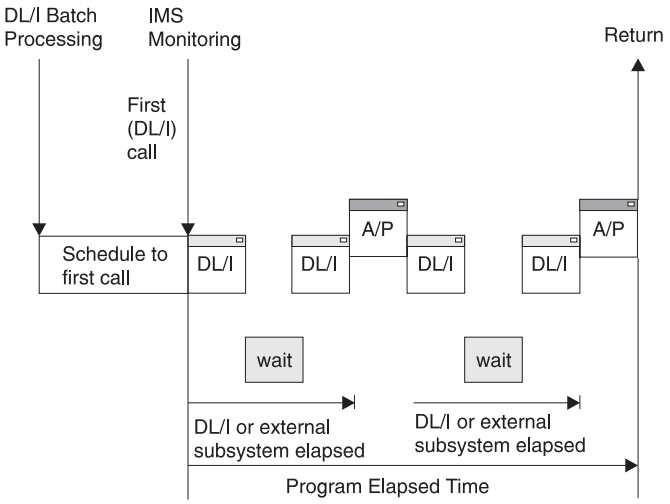


Figure 179. Elapsed Time Event Intervals

Within the elapsed time for a DL/I call, the wait time to obtain segment data is recorded separately. Similarly, within the elapsed time for an external subsystem call, the processing time in the external subsystem is recorded separately as the wait time. The application processing (A/P) time includes many kinds of subsidiary service beyond the machine cycles expended by the program object code—such as subroutine loading, I/O to z/OS data sets, and any overlay processing. If the program is waiting to be dispatched or requires paging before it can use the real storage, these delays are also accounted for in application program processing. Because a program can execute many transactions for each schedule, the elapsed time from schedule to first call is recorded separately. This time covers the initialization performed by the application program and also includes the time for loading the program.

The elapsed times are given in the Program Summary report. Figure 180 on page 452 is an example of the report. Programs are identified by their PSB name on individual lines in the report. Each line gives a summary of the activity for that PSB

during the measured interval. The total number of schedules, DL/I calls, transactions completed (dequeued), and waits for DL/I call I/O calls, the and external subsystem processing are given. The report line gives calculated average times for:

- Elapsed time per schedule
- Processor time per schedule
- Schedule to first DL/I call per schedule
- Elapsed time per transaction

Frequencies for calls per transaction, I/O waits per DL/I call, waits per external subsystem call, and transactions dequeued per schedule are also given. A TOTALS line summarizes all activity for the PSBs active during the monitored interval. (The PSB DUMMY line reconciles any incomplete scheduling caused by a region stopping during scheduling or for a program that experiences a pseudo abend.)

```
     IMS MONITOR   ****PROGRAM SUMMARY****            TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0075
                                                              (A).....(B).....                 (A).....(B).....
                                                    I/O   TRAN.      CPU       .       ELAPSED    SCHED.TO    .       ELAPSED
              NO.    TRANS.          CALLS    I/O  IWAITS  DEQD.     TIME    DISTR.     TIME      1ST CALL  DISTR.     TIME
PSBNAME    SCHEDS.    DEQ.    CALLS  /TRAN   IWAITS /CALL  /SCH.    /SCHED.   NO.      /SCHED.    /SCHED.   NO.      /TRANS.
--------   -------   ------   -----  -----   ------ -----  -----    -------   ---      -------    -------   ---      -------

PROGSC6D         1       13      60    4.6       46   0.7   13.0       10010  884A,B  290146255   15479797  886A,B  22318942
PROGIT8C         3       17     225   13.2      166   0.7    5.6       90592  888A,B  256617508   73283259  890A,B  45285442
PROGTS1C         2       25      47    1.8        0   0.0   12.5       10010  892A,B  239190808    7586234  894A,B  19135264
PROGPS3D         1       23     792   34.4      182   0.2   23.0       10010  896A,B  322812716   48146258  898A,B  14035335
PROGPS3A        13       36    1246   34.6      267   0.2    2.7       49782  900A,B   32801812    2228611  902A,B  11845098
PROGIT1B        11       21      99    4.7        0   0.0    1.9        6341  904A,B   23212388    2036217  906A,B  12158870
PROGSC2B         7      155    3068   19.7     1845   0.6   22.1      346112  908A,B   93655514     789390  910A,B   4229603
PROGIT8A        12       28     434   15.5      293   0.6    2.3       34350  912A,B   30196795    1745815  914A,B  12941483
PROGPS2C         1       10     179   17.9      205   1.1   10.0       10010  916A,B  221024429   53642029  918A,B  22102442
PROGTS1B         8       20      54    2.7        0   0.0    2.5        5447  920A,B   39943245       2895  922A,B  15977298
PROGPS3C         1       14     468   33.4      117   0.2   14.0       10010  924A,B  310644485   35978027  926A,B  22188891
PROGIT1C         1        9      32    3.5        0   0.0    9.0       10010  930A,B  304892631   30226173  932A,B  33876959
PROGSC2C         1        9     160   17.7      101   0.6    9.0       10010  934A,B  296909110   22242652  936A,B  32989901
PROGIT2B         8       21     393   18.7       63   0.1    2.6       21703  938A,B   35126671    1798496  940A,B  13381589
PROGIT2C         6       17     211   12.4       39   0.1    2.8       13312  942A,B  288883508   50698467  944A,B 101958885
PROGTS1D         2       26      50    1.9        0   0.0   13.0       10010  950A,B  284944505   10613350  952A,B  21918808
PROGPS3B         8       22     770   35.0      169   0.2    2.7       35737  954A,B   38016279    2149158  956A,B  13824101
PROGIT1A        11       24     106    4.4        0   0.0    2.1        7925  958A,B   30883486    1935855  960A,B  14154931
PROGSC4A         9      163    1775   10.8     5101   2.8   18.1      235921  963A,B   62172947    3011199  965A,B   3432862
PROGSC6C         1       10      44    4.4       38   0.8   10.0       10010  967A,B  228098334   46568124  969A,B  22809833
PROGPS2B        11       28     557   19.8      604   1.0    2.5       35069  971A,B   33309266    1181831  973A,B  13085783
PROGIT8D         1       12     175   14.5      133   0.7   12.0       10010  975A,B  253392289   21274169  977A,B  21116024
PROGSC4C         1       10      98    9.8      349   3.5   10.0       10010  979A,B  248736332   25930126  981A,B  24873633
PROGSC6A         7      157     789    5.0      457   0.5   22.4       11703  983A,B   73936039     115979  985A,B   3296511
PROGIT2A         7       22     430   19.5       71   0.1    3.1       28529  987A,B   37905001       2982  989A,B  12060682
PROGSC2D         1       15     280   18.6      180   0.6   15.0       10010  991A,B  316194222   41527764  993A,B  21079614
PROGPS2A         6       25     490   19.6      548   1.1    4.1       43177  995A,B   58277945    2467506  997A,B  13986707
PROGSC2A         5      121    2363   19.5     1420   0.6   24.2      276187 1001A,B   88906184    6022954 1003A,B   3673809
PROGIT2D         1       20     361   18.0       62   0.1   20.0       10010 1005A,B  386092737  111426279 1007A,B  19304636
PROGSC4B        10      131    1421   10.8     4115   2.8   13.1      617016 1011A,B   53826667    2632409 1013A,B   4108905
PROGSC4D         1       19     197   10.3      668   3.3   19.0       10010 1020A,B  227999124   46667334 1022A,B  11999953
PROGPS2D         1       13     240   18.4      291   1.2   13.0       10010 1025A,B  327602445   52935987 1027A,B  25200188
PROGSC6B         5      140     694    4.9      395   0.5   28.0       16884 1032A,B   78994223    3290769 1034A,B   2821222
PROGIT1D         1       10      36    3.6        0   0.0   10.0       10010 1041A,B  290379922   15713464 1043A,B  29037992
PROGIT8B         8       17     288   16.9      190   0.6    2.1       33436 1259A,B   35223857       2902 1261A,B  16575932
**TOTALS       173     1403   18632   13.2    18115   0.9    8.1       90328          82303700    2972755          10148638
```

Figure 180. Program Summary Report

You can use the Call Summary report to examine the detail of the call processing for each program, itemized by type or call and summarized for the monitor interval. An extract from the multipage output is given in Figure 181 on page 453. The calls using an I/O PCB are given first and subtotaled. Then, the total calls, of each type, against each database PCB and each external subsystem are listed. The PSB TOTAL line marks the end of data for each program.

```
     IMS MONITOR   ****CALL SUMMARY****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0186
                                                              (C)                (A)                      (B)
                   CALL  LEV          STAT                          IWAITS/       ..ELAPSED TIME...        .NOT IWAIT TIME..   DISTRIB.
PSB NAME PCB NAME  FUNC  NO.SEGMENT   CODE   CALLS     IWAITS   CALL         MEAN      MAXIMUM       MEAN       MAXIMUM    NUMBER
________ ___ ____ ____ ____________   ____   _____     ______   ____         ____      _______       ____       _______    ______
PROGSC6B I/O PCB   ISRT (  )                    138          0   0.00          372         1240          372          1240      598A,B,C
                   GU   (  )                    134        133   0.99      2600917     20974615      2587532      20962866      602A,B,C
                   (GU) (  )                      3          0   0.00           15           16           15           16      716A,B,C
                   ASRT (  )                      3          0   0.00          330          333          330          333      869A,B,C
                   GU   (  )          QC          2          1   0.50     17639806     21219588     17634776     21209529      870A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________             280        134   0.47      1370910                   1364469
                   PSB TOTAL
                   ___ _____                    280        134   0.47      1370910                   1364469
PROGSC2A I/O PCB   ISRT (  )                    118          0   0.00          381         1496          381          1496      603A,B,C
                   GU   (  )                    114        284   2.49      3304809     21784513      3164423      21664181      632A,B,C
                   (GU) (  )                      2          0   0.00           17           18           17           18      781A,B,C
                   ASRT (  )                      3          0   0.00          367          444          367          444      871A,B,C
                   GU   (  )          QC          2          5   2.50     19931897     20045206     19799530     19925277      872A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________             239        289   1.20      1743339                   1675270
                   PSB TOTAL
                   ___ _____                    239        289   1.20      1743339                   1675270
PROGSC2D I/O PCB   ISRT (  )                     14          0   0.00          377          621          377          621      608A,B,C
                   GU   (  )                     14         36   2.57     22360408     52048566     22221852     51901313      634A,B,C
                   I/O PCB SUBTOTAL
                   ___ ___ ________              28         36   1.28     11180393                   11111115
```

Figure 181. Call Summary Report

Monitoring I/O for Application Program DL/I Calls

The IMS Monitor report shows the total number of I/O occurrences and the total time the occurrences took for each application program executed during a monitored interval. The Program I/O report gives these two totals for all PSBs active during the monitored interval and includes the detailed breakdown of the I/O wait time as it was incurred by each PCB used by the program. Figure 182 on page 455 shows an example of the report.

The detail of the report reveals much of the contention experienced during application program processing. Each type of conflict and the number of times it occurred are recorded for each I/O PCB. The report shows the total wait time, the highest wait experienced, and the average time. Subtotals are given for each PCB under a PSB, and for all PCBs under each PSB.

The DDN/FUNC column lists the data set by ddname. The MODULE column uses a code to indicate the source of the contention. The types of conflicts and codes are shown as follows:

- **Message handling**

Code	Conflict
MFS	MFS format library directory
PMM	Message format buffer pool space or control block I/O
QMG	Message queue management

- **Scheduling**

Code	Conflict
BLR	Load/read from ACBLIB
MSC	MPP region initialization
SMN	Virtual storage management

For external subsystem calls, the elapsed time to complete the processing is considered wait time. The DDN/FUNC column indicates the external subsystem call function, as follows:

- **External subsystems**

Code	Subsystem call function
AB0	ABORT
CT0	Create thread
D50	Terminate identify or thread, signoff
D80	INIT
I30	Identify, command, echo, terminate
I30	Identify, terminate subsystem
I50	INIT
I60	Resolve-in-doubt
PR0	Subsystem-not-operational
P10	Commit prepare (Phase 1)
P20	Commit continue (Phase 2)
SO0	Signon
SI0	Identify

```
   IMS MONITOR   ****PROGRAM I/O****          TRACE START 1993 022  14:00:18   TRACE STOP 1993 022  14:02:20 PAGE 0088
                                  .........IWAIT TIME.........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR1A I/O PCB          122     2341116       19189       70795   HOTELDBA  DBH
                           34    24177936      711115     3950160   **W F I
                           40    23652665      591316     2668917   **W F I
                            5       67613       13522       21214   SHMSG     QMG
                            4      110363       27590       60486   QBLKS     QMG

       PCB TOTAL
       ___ _____
                         131     2519092       19229
PSB TOTAL
___ _____                305     6725063       20049
PROGDE1A TRMNALDA                    20      624677       31233       68252   TRMNALDA  VBH
                                      1      275811      275811      275811 PI TRMNALDA....

        PCB TOTAL
        ___ _____
                                     21      900488       42880
         I/O PCB                     16      488812       30550       79980   TRMNALDA  VBH
                                      1       16118       16118       16118   SHMSG     QMG

        PCB TOTAL
        ___ _____
                                     17      504930       29701
         TABLEDBA                    16      290471       18154       33254   TABLEDA   DBH

        PCB TOTAL
        ___ _____
                                     16      290471       18154
PSB TOTAL
___ _____                            54     1695889       31405
PROGHR2B HOTELDBB                     8      698384       87298      184475   HOTELDBB  DBH
                                      4     5820650     1455162     1455278 PI HOSINDXB....
                                      4     4481024     1120256     1209075 PI HOTELDBB....
                                      2      260817      130408      232750   HOSINDOB  VBH
                                      7      106623       15231       16410   HOSINDXB  VBH
                                      1       15366       15366       15366   HOTELDBD  DBH

        PCB TOTAL
        ___ _____
                                     26    11382864      437802
PSB TOTAL
___ _____                            26    11382864      437802
PROGHR2A HOTELDBA                    17      655801       38576      366108   HOSINDXA  VBH
                                     73     1836721       25160       82141   HOTELDBA  DBH
                                      2       54663       27331       41975   HOTELDBD  DBH
                                      1        9887        9887        9887   HOTELDBC  DBH
                                      2      851042      845635      845635   HOSINDOA  VBH

        PCB TOTAL
        ___ _____
                                     95     3408114       35874
         I/O PCB                     20      575847       28792       74227   HOTELDBA  DBH
                                     21      370390       17637       43153   HOSINDXA  VBH
```

Figure 182. Program I/O Report (Part 1 of 3)

```
     IMS MONITOR ****PROGRAM I/O**** TRACE START 1993 022 14:00:18  TRACE STOP  1993 022  14:02:20  PAGE 0089
                                    .........IWAIT TIME..........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR2A I/O PCB            5     4654544      930908     2020043  **W F I
                            8    32796604     4099575     9328891  **W F I

        PCB TOTAL
         ___ _____         41      946237       23078
PSB TOTAL
___ _____                 136     4354351       32017
PROGPS2A LOGIMA            89     2046670       22996       73593   IMMSTR3A   VBH
                          612    53886417       88049      185674   IMMSTR1A   VBH
                            3       44906       14968       20788   IMINDEXA   VBH

        PCB TOTAL
        ___ _____         704    55977993       79514
                          469    11742900       25038      170337   COMPOSDA   DBH
                          329     8198418       24919       91422   CPINDEXA   VBH

        PCB TOTAL
        ___ _____         798    19941318       24989
         I/O PCB            3       47511       15837       20806   SHMSG      QMG

        PCB TOTAL
        ___ _____           3       47511       15837
PSB TOTAL
___ _____                1505    75966822       50476
PROGSC6C I/O PCB           52     2698602       51896      473763   INVENTRC   VBH
                            4       70921       17730       34241   SHMSG      QMG
                            3       50699       16899       24724   QBLKS      QMG

        PCB TOTAL
        ___ _____          59     2820222       47800
                           55     2666884       48488      210752   INVENTRC   VBH
                           50      797587       15951       41706   ININDEXC   VBH
                            1      119253      119253      119253 PI INVENTRC...1
                            1        8634        8634        8634   INVENTRB   VBH
                            2       83947       41973       53936   INVENTRA   VBH

        PCB TOTAL
        ___ _____         109     3676305       33727
PSB TOTAL
___ _____                 168     6496527       38669
PROGHR2D I/O PCB           21     2285296      108823      199223   HOTELDBD   DBH
                           28      762370       27227      111860   HOSINDXD   VBH
                            1       11685       11685       11685   SHMSG      QMG

        PCB TOTAL
        ___ _____          50     3059351       61187
         HOTELDBD          96     6279107       65407      139032   HOTELDBD   DBH
```

Figure 182. Program I/O Report (Part 2 of 3)

```
 MONITOR   ****PROGRAM I/O**** TRACE START 1993 022 14:00:18 TRACE STOP  1993 022  14:02:20  PAGE 0090
                                .........IWAIT TIME.........
PSBNAME  PCB NAME      IWAITS       TOTAL        MEAN     MAXIMUM   DDN/FUNC  MODULE
_______  ___ ____      ______       _____        ____     _______   ________  ______

PROGHR2D HOTELDBD          31     2130585       68728      769130   HOSINDXD   VBH
                            3      115999       38666       56394   HOTELDBA   DBH
                            2       69833       34916       43470   HOTELDBC   DBH
                            2       41430       20715       28020   HOSINDOD   VBH
                            4     5515374     1378843     1458884 PI HOSINDXD....
                            4     3997017      999254     1026228 PI HOTELDBD....

PCB TOTAL
___ _____
                          142    18149345      127812
PSB TOTAL
___ _____
                          192    21208696      110461
```

Figure 182. Program I/O Report (Part 3 of 3)

The I/O waits for the calls to the I/O PCB are grouped as the first entries for a PSB. For DC DL/I calls, the data set for which the I/O took place is indicated under the DDN/FUNC heading, and the module code tells you what type of conflict caused the wait. For external subsystem calls, the function is indicated under the DDN/FUNC heading, and the module code indicates the source of the call entry.

Names other than LGMSG and SHMSG can appear under the DDN/FUNC column for I/O PCBs.

If the program is designated as wait for input and has to wait for the input of the next message, the wait entry is marked **WFI under the DDN/FUNC heading and no entry appears in the MODULE column. The time spent waiting for the next input message is shown under wait time. **WFI entries are shown for information only and their values are not used to compute statistics.

Monitoring MFS Activity

You can obtain a summary of all activity that occurs for management of message format buffer pool use from the Message Format Buffer Pool report. The report is illustrated in Figure 183 on page 458. The data shows the counts at the start and end of the trace interval and their difference.

When message formatting occurs, the appropriate message blocks must reside in the message format buffer pool, a DIF/MID pair for input or a DOF/MOD pair for output. If the blocks are not already in the buffer, I/O to the active IMSFORMATA/B library must occur. Block retrieval can involve a prior directory lookup, or be direct, using an index kept in the pool.

Many of the counts reveal details of internal event management. The number of times there is no directory entry for a block implies extra directory lookup I/O. Delays caused by unavailable FRE entries are recorded as request-ignored counts.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0007

                M E S S A G E   F O R M A T   B U F F E R   P O O L

                                                                5:55:15          5:59:49
                                                              START TRACE      END   TRACE       DIFFERENCE

    NUMBER OF P/F REQUESTS                                              0              0                0
    NUMBER OF I/F REQUESTS                                             18             20                2
    NUMBER OF I/F I/O'S                                                 2              2                0
    NUMBER OF TIMES POOL COMPRESS WOULD BE SUCCESSFUL                   0              0                0
    NUMBER OF DIRECTORY I/O OPERATIONS                                  2              2                0
    NUMBER OF TIMES BLOCK WASHED FOR FRE                                0              0                0
    NUMBER OF TIMES P/F REQUEST IGNORED                                 0              0                0
    NUMBER OF F/B REQUESTS                                             18             20                2
    NUMBER OF TIMES F/B REQUEST IGNORED                                 0              0                0
    NUMBER OF TIMES I/F ON F/B QUEUE                                   16             18                2
    NUMBER OF TIMES I/F ON I/F QUEUE                                    0              0                0
    NUMBER OF TIMES F/B ON I/F QUEUE                                   18             20                2
    NUMBER OF TIMES P/F ON I/F QUEUE                                    0              0                0
    NUMBER OF TIMES P/F ON F/B QUEUE                                    0              0                0
    NUMBER OF TIMES THERE WAS NO DIR ENTR FOR A BLOCK                   0              0                0
    NUMBER OF TIMES I/O ERRORS POINT OR READ MACRO                      0              0                0
    NUMBER OF IMMEDIATE I/O REQUESTS WAITED DUE TO MAXIMUM I/O          0              0                0
    NUMBER OF REQUESTS SATISFIED BY INDEX/DYNAMIC DIRECTORY             0              0                0

    QUOTIENT :  IMMEDIATE FETCH I/O'S + DIRECTORY I/O'S OPERATIONS =    0.00
                ____________________________________________________________________________________
                                    TOTAL NUMBER OF TRANSACTIONS
```

Figure 183. Message Format Buffer Pool Report

Monitoring Message Queue Handling

A key resource that directly affects the efficiency of transaction processing is the message queue pool and the management of the I/O to the message queues. You can examine the activity by looking at the Message Queue Pool report. Figure 184 illustrates the report contents. Counts of activities are given at start and end of the trace interval and as the differences between start and end numbers.

```
***I M S  M O N I T O R***  BUFFER POOL STATISTICS     TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0002

                M E S S A G E   Q U E U E   P O O L

                                                                5:55:15          5:59:49
                                                              START TRACE      END   TRACE       DIFFERENCE

    NUMBER OF LOCATE CALLS FROM QMGR                                54204            68436            14232
    NUMBER OF RECORD RELEASE CALLS FROM QMGR                        16431            20738             4307
    NUMBER OF LOCATE AND ALTER CALLS FROM QMGR                     131593           164744            33151
    NUMBER OF REQUESTS TO PURGE THE Q POOL                              2                2                0
    NUMBER OF ADDRESS TO DRRN TRANSLATION REQUESTS                  21351            27076             5725
    NUMBER OF REQUESTS TO WAIT FROM QMGR                                0                0                0
    NUMBER OF READ REQUESTS                                           962              962                0
    NUMBER OF WRITE REQUESTS(TOTAL)                                   499              499                0
    NUMBER OF WRITES DONE BY PURGE                                    499              499                0
    NUMBER OF WAITS FOR PURGE COMPLETION                                1                1                0
    NUMBER OF WAITS BECAUSE NO BUFFER AVAILABLE                         0                0                0
    NUMBER OF WAITS FOR OTHER DECB TO READ THIS BUFFER                823              823                0
    NUMBER OF WAITS FOR OTHER DECB TO WRITE THIS BUFFER                 0                0                0
    NUMBER OF WAITS FOR CONFLICTING END DEQ BUFFER REQ                  0                0                0
    NUMBER OF PSBS UNCHAINED FROM BUFFERS                               0                0                0
    NUMBER OF CALLS TO QMGR.(TOTAL)                                 48164            62213            14049
    NUMBER OF CALLS TO REPOSITION A LOST BUFFER                         0                0                0
    NUMBER OF CALLS TO ENQ A MESSAGE                                10583            13441             2858
    NUMBER OF CALLS TO DEQ ONE OR MORE MESSAGE                       6321             7767             1446
    NUMBER OF CALLS TO CANCEL INPUT OR OUTPUT                         119              121                2

    QUOTIENT :  TOTAL NUMBER OF OSAM READS + OSAM WRITES + ALL IWAITS =     0.00
                ____________________________________________________
                                TOTAL NUMBER OF TRANSACTIONS
```

Figure 184. Message Queue Pool Report

Detecting Checkpoint Effects

When a checkpoint command specifies SNAPQ, the current status of all message queues is written to the system log. This prevents any message handling on behalf of queue management. `General Iwait Time Events` report records the wait time incurred by the SNAPQ. Figure 185 shows the activity on the summary line `QMGR SNAPQ CHECK`. The number of occurrences is given with the total, average, and maximum wait times.

```
       IMS MONITOR   ** GENERAL REPORTS **            TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0009
                GENERAL IWAIT TIME EVENTS
    EVENT                              ..........IWAIT TIME...........    DISTRIBUTION
    IWAITS          OCCURRENCES        TOTAL         MEAN      MAXIMUM       NUMBER
    ______          ___________        _____         ____      _______       ______
QMGR SNAPQ CHECK              0            0            0            0            0
                REGION AND JOBNAME REPORT
REG. NO.   JOB NAME
________   ________
     1     MPR1A100
     2     MPR1A209
     3     MPR1A210
     4     MPR1A211
     5     MPR1A103
     6     MPR1A101
     7     MPR1A115
     8     MPR1A116
     9     MPR1A216
    10     MPR1A200
    11     MPR1A217
    12     MPR1A119
    13     MPR1A218
    14     MPR1A219
    15     MPR1A104
    16     MPR1A220
    17     MPR1A203
    18     MPR1A123
    19     MPR1A222
    20     MPR1A105
    21     MPR1A124
    22     MPR1A223
    23     MPR1A107
    24     MPR1A224
    25     MPR1A106
    26     MPR1A206
    27     MPR1A205
    28     MPR1A108
    29     MPR1A109
    30     MPR1A208
    31     MPR1A111
    32     MPR1A112
    33     MPR1A113
    34     MPR1A204
    35     MPR1A114
    36     MPR1A102
    48     MPR1A121
    49     MPR1A122
    50     MPR1A221
```

Figure 185. General Reports for SNAPQ Effects

Transaction Queuing Report

In addition to monitoring the efficiency of message handling, you can monitor the service provided for each application, by looking at the size of the transaction queues at each scheduling of their processing programs.

The Transaction Queuing report shown in Figure 186 on page 460 records, for each transaction, the minimum, average, and maximum counts at scheduling time. The total number of dequeued transactions (or transactions that have been fully processed) during the monitored interval is given for each transaction code. The average number of transactions processed for each scheduling is given in the `DEQUEUED MEAN` column.

```
     IMS MONITOR   ****TRANSACTION QUEUING****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0181
                                                          (B)                    (A)
                   NUMBER      NUMBER      ..ON QUEUE WHEN SCHEDULED.....    DEQUED      DISTRIBUTION
TRANSACTION        DEQUED      SCHEDS.     MINIMUM    MEAN        MAXIMUM    MEAN        NUMBER
___________        ______      _______     _______    ____        _______    ____        ______

 SC6X                13          1           0       0.00           0      13.00         883A,B
 IT8W                17          3           0       0.00           0       5.66         887A,B
 TS1Z                16          1           0       0.00           0      16.00         891A,B
 PS3X                23          1           0       0.00           0      23.00         895A,B
 PS3Y                17          7           0       0.00           0       2.42         899A,B
 IT1V                11          6           0       0.00           0       1.83         903A,B
 SC2Z               143          2           0       0.00           0      71.50         907A,B
 IT8U                12          7           0       0.00           0       1.71         911A,B
 PS2W                10          1           0       0.00           0      10.00         915A,B
 TS1U                12          4           0       0.00           0       3.00         919A,B
 PS3W                14          1           0       0.00           0      14.00         923A,B
 IT8Y                16          5           0       0.00           0       3.20         927A,B
 IT1W                 9          1           0       0.00           0       9.00         929A,B
 SC2W                 9          1           0       0.00           0       9.00         933A,B
 IT2V                13          5           0       0.00           0       2.60         937A,B
 IT2W                17          6           0       0.00           0       2.83         941A,B
 TS1V                 9          1           0       0.00           0       9.00         945A,B
 SC2V                12          5           0       0.00           0       2.40         947A,B
 TS1W                11          1           0       0.00           0      11.00         949A,B
 PS3V                13          3           0       0.00           0       4.33         953A,B
 IT1U                 9          6           0       0.00           0       1.50         957A,B
 SC4U                11          5           0       0.00           0       2.20         962A,B
 SC6W                10          1           0       0.00           0      10.00         966A,B
 PS2V                 8          6           0       0.00           0       1.33         970A,B
 IT8X                12          1           0       0.00           0      12.00         974A,B
 SC4W                10          1           0       0.00           0      10.00         978A,B
 SC6U                14          6           0       0.00           0       2.33         982A,B
 IT2Y                 9          3           0       0.00           0       3.00         986A,B
 SC2X                15          1           0       0.00           0      15.00         990A,B
 PS2Y                17          2           0       0.00           0       8.50         994A,B
 SC4Y               152          4           0       0.50           1      38.00         998A,B
 SC2Y               106          2           0       0.00           0      53.00        1000A,B
 IT2X                20          1           0       0.00           0      20.00        1004A,B
 SC2U                15          3           0       0.00           0       5.00        1008A,B
 SC4Z               123          5           0       0.60           1      24.60        1010A,B
 TS1X                15          1           0       0.00           0      15.00        1015A,B
 SC4X                19          1           0       0.00           0      19.00        1019A,B
 PS2X                13          1           0       0.00           0      13.00        1024A,B
 PS2Z                20          5           0       0.00           0       4.00        1028A,B
 SC6Z               130          1           0       0.00           0     130.00        1031A,B
 SC6V                10          4           0       0.00           0       2.50        1035A,B
 SC6Y               143          1           0       0.00           0     143.00        1037A,B
 IT1X                10          1           0       0.00           0      10.00        1040A,B
 PS3U                19          6           0       0.00           0       3.16        1131A,B
 IT2U                13          4           0       0.00           0       3.25        1146A,B
```

Figure 186. Transaction Queuing Report

Monitoring Line Activity

You can obtain a summary of all occurrences of activity for each BTAM line or VTAM node that handles message traffic during the monitored interval. The elapsed times and NOT-WAIT times are given in categories of total, mean, and maximum times for each communication line in the Communication Summary report. Figure 187 on page 461 illustrates this report.

Requirement: You must match which physical devices are using the line to the Stage 1 output from system definition. The line numbers are assigned sequentially, according to their physical occurrence in the Stage 1 input deck.

If your online system specifies the prefetch option for MFS blocks in the control region JCL, the last line of the report contains the statistics for all prefetch events.

You can also investigate the amount of data transmitted across BTAM lines or for VTAM nodes with the Line Functions report. Figure 188 on page 461 illustrates this report. The report distinguishes between input data and output data. The number of blocks of data and the average and maximum size of the blocks are recorded for data received by IMS and for transmitted data.

This report also includes a measure of how inactive the lines are. An inactive interval is assumed to be the difference between the time that marks the end of the last input block received and the starting time for output transmission. These occurrences of inactivity are termed turnaround intervals, and the report cumulates the number of occurrences as well as the average and maximum times associated with these intervals.

If the line is being used by an MFS supported terminal, a count of the number of requests for next page for a multipage message is recorded.

If link traffic for coupled multiple systems is recorded, a set of three reports follows the Line Functions report. These are described in “Interpreting IMS Monitor MSC Reports” on page 468.

```
   IMS MONITOR   ****COMMUNICATION SUMMARY****       TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0089
                                                 (A)                                (B)
    NODE OR                                .....ELAPSED TIME.....       NOT IWAIT TIME(ELAPSED-IWAIT)    DISTRIBUTION
  LINE NUMBER       OCCURRENCES       TOTAL        MEAN     MAXIMUM       TOTAL        MEAN     MAXIMUM      NUMBER
 ____ _____       ___________       _____        ____     _______       _____        ____     _______      _____
    PMT01A                  3        2396         798        1547        2396         798        1547       1467A,B
        19                182       92155         506        1106       92155         506        1106       1493A,B
         2                 59        2280          38          41        2280          38          41       1515A,B
     TOTAL
     _____
                          244       96831         396                   96831         396
```

Figure 187. Communication Summary Report

```
   IMS MONITOR   ****LINE FUNCTIONS***              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0091
                              (A).....................(B).............                  .....................
                                   MEAN     MAX.           MEAN    MAX.     .        TURN       .                    .
  NODE OR   DEVICE  RECEIVE RECEIVE RECEIVE   TRANS.  TRANS.  TRANS.  DIST.      AROUND      MEAN         MAX.   DIST.   PAGING
LINE NUMBER  TYPE    BLOCKS BLKSIZE BLKSIZE   BLOCKS BLKSIZE BLKSIZE NUMBER    INTERVALS   INTERVAL    INTERVAL  NUMB.  REQUESTS
____ _____  ____    ______ _______ _______   ______ _______ _______ _____     _________   ________    ________  _____  ________
  PMT01A    3270V        1      29      29        2     170     171   1468A,B         3         798        1547   1466         0
      19    XXXX                                                                   182         506        1106   1492         0
       2    LOC SYS                                                                 59          38          41   1514         0
ALL LINES
___ _____                 1      29               2     170                       244         396                             0
```

Figure 188. Line-Functions Report

Monitoring Message Handling Efficiency

The IMS Monitor produces both summary and detailed information on asynchronous processing in the IMS control region. The arrival of data transmitted from BTAM terminals or from VTAM triggers the processing. Application program responses also result in processing. The space in four major buffer pools and access to format, SPA, and message queue data sets are managed for the total communications traffic. Wait times are recorded when contention for pool space or I/O interrupts the processing of any of the communication tasks triggered by line activity. This information is contained in the Communication Wait report. Figure 189 on page 462 illustrates this report.

This report is complementary to the Communication Summary report in that the line number is used as an identification for the series of communication processing tasks.

```
     IMS MONITOR   ****COMMUNICATION IWAIT*****        TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0090
  NODE OR                        .........IWAIT TIME..........                                                    DIST.
LINE NUMBER  OCCURRENCES       TOTAL        MEAN     MAXIMUM     FUNCTION           BLKSIZE  MODULE       NO.
____ ______  ___________       _____        ____     _______     ________           _______  ______       ____
ALL LINES...
PREFETCH I/O
_______ ___         NONE
```

Figure 189. Communication Wait Report

IMS Internal Resource Usage

There are several summary reports that you can use to examine the level of internal contention for resources. The following sections give a brief explanation of these reports.

Pool Space Contention

The Pool Space Failure Summary report gives the number of times in each region a given amount of storage was unavailable. It shows the number of bytes and the identification of the pool as well as the number of occurrences of this failure to obtain storage. You can use this summary to determine whether you need to increase the buffer pool allocation by a system definition change or by overriding the number of buffers in the EXEC statements in the JCL.

The format of the report is shown in Figure 190.

```
POOL SPACE FAILURE SUMMARY

          POOL ID    BYTES REQ.   OCCURRENCES
          DLMP           8888           1
     TOTAL                              1
```

Figure 190. Pool Space Failure Report

IMS Latch Conflict

The basic serialization of the task processing in IMS is controlled by ownership of an IMS latch. When different programs are executing, they compete for the ownership. If they wait for the resource, the one possessing the latch has to post the other ITASK waiting for it. You can judge the level of contention for a resource and then investigate a set of changes to relieve the pressure.

The different types of latches and the counters that exhibit the level of contention are given in the Latch Conflict Statistics report. Figure 191 on page 463 is an example of this report. The entries are organized according to the latch names.

For the latch names and abbreviations for the different types of resources being serialized, see “IMS Latch Conflict” on page 407.

When a system checkpoint is taken during the time the monitor is active, latch conflict statistics are reset to zero, thus corrupting the values presented in this report. If this situation exists, the following message will be inserted at the top of the report:

```
**** A CHECKPOINT OCCURRED DURING MONITOR RUN ****
****  LATCH CONFLICT STATISTICS ARE INVALID   ****
****      SEE UTILITIES REFERENCE MANUAL      ****
```

However, if the master terminal operator issues the /CHECKPOINT command with the STATISTICS keyword parameter, latch conflict statistics are reset to zero, but the IMS monitor is not notified. Therefore, DFSUTR20 cannot detect that the statistics have been corrupted and does not issue this message.

Recommendation: Do not issue statistics checkpoints while the Monitor is running.

The counters are primarily concerned with storage management and logging services. The statistics recorded are the number of times contentions occur, that is, the resource waits for a latch.

```
        IMS MONITOR   ** GENERAL REPORTS **           TRACE START 1993 209...

                LATCH CONFLICT STATISTICS

LATCH       COUNT                 AT          AT
NAMES       FIELD           START         END        DIFF.

LOGL     CONTENTIONS              0           0           0

SMGT     CONTENTIONS              0           0           0

XCNQ     CONTENTIONS              0           0           0

ACTL     CONTENTIONS              0           0           0


CBTS     CONTENTIONS              0           0           0

DBLK     CONTENTIONS              0           0           0
```

Figure 191. Latch Conflict Statistics Report

Using Frequency Distributions from IMS Monitor Output

The reports that are derived from the IMS Monitor data records contain many summary lines where the mean time is given. If you are interested in the distribution of those timed events, rather than just average and maximum times, you can request the Report Print utility to individually record the events in a frequency distribution across a range of intervals. Some distributions are not time dependent, such as those for transaction queue loads or transmitted block sizes.

How to Get a Frequency Distribution Output

To request the IMS Monitor Report Print utility to gather distribution data, include a DIS input control statement. This causes all report items with an entry under a column headed MEAN to have a corresponding frequency distribution as part of the Distribution Appendix report. Each report line includes an identifying reference number under the column headed Distribution Number. You can use the reference number to locate the distribution data flagged by that number in the appendix.

The following tables show the major IMS Monitor reports and the type of frequency distributions generated for each report. Each type results in several distributions, depending on how many entries are in each section of the report. For each type of frequency distribution the data is cumulated in suitable intervals or ranges. The set of ranges used for each type is given an identifier, shown in the ID column. Table 45 on page 464 shows the report distributions sorted by Region Summary.

Table 45. Report Distributions by Region Summary

Report Name	ID	Description
Scheduling and Termination	D1	Elapsed time
	D2	Not wait time
Schedule end to 1st DL/I call	D3	N/A
Elapsed execution time DL/I calls	D4	N/A
	D5	Elapsed time
External Subsystem calls	D6	Not wait time
Waits per DL/I call	D43	Elapsed time
Idle for intent Checkpoint	D7	N/A
	D8	N/A
	D20	Elapsed time
	D21	Not wait time

Table 46 shows the report distributions Programs Region.

Table 46. Report Distributions by Program Region

Report Name	ID	Description
Elapsed execution time	D30	N/A
Schedule and to 1st DL/I call	D31	N/A

Table 47 shows the report distributions sorted by Program Summary.

Table 47. Report Distributions by Program Summary

Report Name	ID	Description
Processor time per schedule	D15	N/A
Transactions dequeued per schedule	D14	N/A
Elapsed time per schedule	D9	N/A
Schedule end to 1st DL/I call	D10	N/A

Table 48 shows the report distributions sorted by Communication Summary.

Table 48. Report Distributions by Communication Summary

Report Name	ID	Description
Line elapsed time	D18	N/A
Line not wait time	D19	N/A

Table 49 shows the report distributions sorted by Line Functions.

Table 49. Report Distributions by Line Functions

Report Name	ID	Description
Received block length	D36	N/A
Transmitted block length	D37	N/A
Inactive intervals	D38	N/A

Table 50 shows the report distributions sorted by MSC Queuing Summary.

Table 50. Report Distributions by MSC Queuing Summary

Report Name	ID	Description
Time in queue	D39	N/A

Table 51 shows the report distributions sorted by Transaction Queuing.

Table 51. Report Distributions by Transaction Queuing

Report Name	ID	Description
Transactions on queue at schedule	D17	N/A
Transactions dequeued per schedule	D16	N/A
Prefetch format blocks	D28	Elapsed time
	D29	Not wait time

Table 52 shows the report distributions sorted by Call Summary.

Table 52. Report Distributions by Call Summary Queuing

Report Name	ID	Description
PSB waits per DL/I call	D13	N/A
PSB waits per external subsystem call	D44	N/A
PSB elapsed time per call	D11	N/A
PSB not wait time per call	D12	N/A
PSB external subsystem calls	D45	Elapsed time

Table 53 lists some distributions derived from buffer pool statistics for wait times.

Table 53. Wait Time Distributions

Function	ID	Module Key
Storage	D22	SMN
Scheduler internal	D25	MSC
Queue manager I/O	D26	QMG
Block loader I/O	D27	BLR
MFS block I/O	D32	MFS
MFS directory I/O	D33	MFS
Format buffer pool space	D35	PMM
QMGR SNAPQ check	D42	None

How Frequency Distribution Ranges Are Defined

A set of ten intervals is defined for each summary line and the occurrences falling in each interval are cumulated. The interval ranges are preset with default end points. For example, the end points, for DL/I call elapsed time are: 0, 1000, 2000, 4000,

8000, 16000, 32000, 64000, 128000, 256000, INF (all times are in milliseconds). The default end points are chosen so that they are suitable to the event. The lower limit of the first interval always defaults to zero, and the upper limit of the tenth interval is infinity (INF).

Although several types of distribution can use the same set of end points, each type is assigned a distribution identifier. You can use this to redefine the end points. To override the default end points you include an input control statement to the Report Print utility. The statement specifies the type of distribution identifier and gives the desired end point values.

Example: The DL/I call elapsed time end points could be respecified by:

```
D5   0,500,1000,1500,2000,4000,,,100000,500000
```

The values of the unspecified end points remains at their default values of 32000 and 64000 as does the last (INF).

Figure 192 shows a sample page from the Distribution Appendix report, which gives an example of how ranges vary with the type of distribution. The lines are arranged in pairs, with the second one recording the cumulated counts.

```
     IMS MONITOR   ****DISTRIBUTION APPENDIX****       TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0200

#    1...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    2...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    3...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    4...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    5...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          6
#    6...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          8
#    7...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#    8...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          9
#    9...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   10...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  1          0          0          0          0          0          0          0          0          7
#   11...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   12...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          8
#   13...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   14...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
#   15...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  1          0          0          0          0          0          0          0          0          8
#   16...........0.....200000.....400000.....600000.....800000....1000000....1200000....1400000....1600000....1800000....INF
                  0          0          0          0          0          0          0          0          0          1
```

Figure 192. Distribution Appendix Report

Default Values of Distribution Definitions

Using an identifier provided in the frequency distribution tables (Table 45 on page 464 through Table 52 on page 465) and the Wait Time Distributions table (Table 53 on page 465) you can determine the default end points for the distribution by locating it in the following list:

D1, D2, D5, D6, D9, D10, D11, D12, D15 D18, D19, D20, D21, D22, D25, D27, D28, D29, D30, D31, D43, and D45

0, 1000, 2000, 4000, 8000, 16000, 32000, 64000, 128000, 256000, INF

D3	0, 50000, 100000, 150000, 200000, 250000, 300000, 350000, 400000, 450000, INF
D4	0, 200000, 400000, 600000, 800000, 1000000, 1200000, 1400000, 1600000, 1800000, INF
D7, D13, D44	0, 0, 1, 2, 3, 4, 5, 6, 7, 8, INF
D8	0, 100000, 200000, 300000, 400000, 500000, 600000, 700000, 800000, 900000, INF
D14, D16, D17	0, 1, 2, 3, 4, 5, 10, 15, 30, 90, INF
D23, D24, D26, D32, D40, D42	0, 2000, 8000, 24000, 50000, 100000, 150000, 200000, 250000, 300000, INF
D33, D34, D35	0, 2000, 4000, 8000, 16000, 32000, 64000, 96000, 128000, 160000, INF
D36, D37	0, 10, 20, 40, 80, 100, 200, 400, 800, 1000, INF
D38	0, 1000, 10000, 100000, 200000, 500000, 800000, 1000000, 1500000, 2000000, INF
D39	0, 1000, 5000, 10000, 50000, 100000, 500000, 1000000, 5000000, 10000000, INF

Interpreting Distribution Appendix Output

You can use the detailed output in the Distribution Appendix when you suspect an unusual combination of events was reported in a report summary line. Usually, the average and maximum times or counts are sufficient to highlight a resource usage problem. However, if you suspect the mean value to be masking an unusual distribution you can draw on the detail contained in the IMS Monitor output records.

For example, suppose you are investigating a change in the scheduling algorithm for a particular transaction and need to know how many transactions were able to be processed for each scheduling of an application program. Figure 193 shows the processed transactions in a histogram:

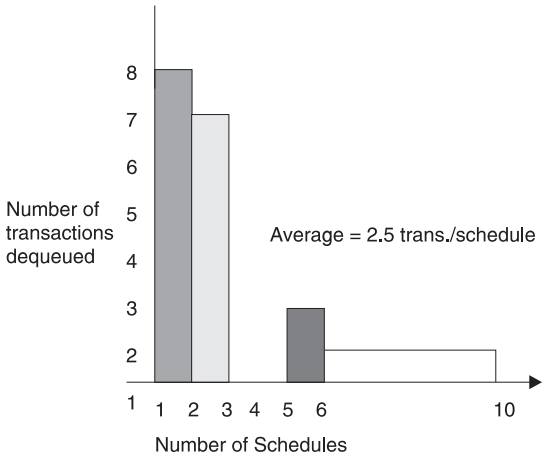


Figure 193. Number of Transactions Processed For Each Scheduling Of An Application Program

The average is 2.5 transactions per schedule. The distribution in Figure 193 on page 467 suggests that many schedules were able to process only one or two transactions, and few schedules significantly exhausted the queue. The distribution data for the histogram is as follows:

```
Number of schedules    1    2    3    4    5    6-10    >10

Transactions dequeued  8    7    0    0    2    1       0
```

The Distribution Appendix presents the histogram data in the form of two lines:

- The first line shows the intervals, prefixed by a cross reference to an individual line on the earlier output.
- The second line gives the number of events occurring in those intervals.

This data appears as follows:

```
# 950B...0...1...2...3...4...5...10...15...30...90...INF
           8   7   0   0   2   1    0    0    0    0
```

The cross reference `950B` points to a unique report line. For example, the Transaction Queuing report on the appropriate line for the transaction of interest shows `950A,B` under the column headed `DISTRIBUTION NUMBER`. Use the reference number 950B to locate the data in the Distribution Appendix. The 950A reference points to the data for the number of transactions in the queue at schedule time.

Interpreting IMS Monitor MSC Reports

The IMS Monitor Report Print program includes three reports that highlight message events caused by system coupling. They are:

- MSC Traffic report

  For the monitor interval, this report shows the enqueue and dequeue counts of messages that use the various link paths.
- MSC Summaries

  This report shows summaries of:
  - The traffic queues for each input transaction name
  - The traffic queues for each destination name
  - The traffic queues for each link number
  - The traffic queues for each destination system
- MSC Queuing Summary report

  This report is generated only when intersystem messages are queued on the local system before being sent to the destination system. The local system must be an intermediate system. This report shows:
  - Maximum time messages spend in queues
  - Average time messages spend in queues
  - Maximum queue lengths
  - Maximum queue counts
  - Total number of messages queued for all links in which the local system participates

All three of the reports can have entries in the Distribution Appendix. You can examine the frequency distributions of the traffic if you suspect unusual transmission patterns.

Determining Cross–System Queuing

The MSC Traffic report reveals the individual queue loads for all traffic between partner systems of which the monitored system is the local system. The report lists all the unique system identification numbers (SIDs) that are defined for communications for that local system. It then summarizes the total messages queued and dequeued for each combination of the following variables:

- Input name (terminal or program that was a message source)
- Destination name (terminal or program)
- Input system (SID)
- Destination system (SID)
- Link number
- Link type (BSYN, MTM, CTC, or VTAM)

Figure 194 on page 470 illustrates this report. If a message originates in the local system, its presence is accounted for in the dequeue counts only. Messages with local destinations appear only in the enqueue count.

```
     IMS MONITOR   ****MSC TRAFFIC REPORT****          TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0151
LOCAL SID VALUES = 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115
 INPUT     DESTIN.   INPUT  DEST.  LINK  LINK  ENQUEUE  DEQUEUE
  NAME      NAME      SID    SID    NO.  TYPE    COUNT    COUNT

DSWT3685  DSWT3685      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT6161  DSWT6161      3      3     3    C-C        0        1
          SC6Z           3    103     3    C-C        1        0
DSWT3838  DSWT3838      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT4618  DSWT4618      3      3     3    C-C        0        1
          SC6Z           3    103     3    C-C        1        0
DSWT3903  DSWT3903      3      3     3    C-C        0        1
          SC2Z           3    103     3    C-C        1        0
DSWT5418  DSWT5418      3      3     3    C-C        0        1
          SC4Z           3    103     3    C-C        1        0
DSWT4673  DSWT4673      3      3     3    C-C        0        1
          SC2Z           3    103     3    C-C        1        0
DSWT5141  DSWT5141     45     45    45   VTAM        0        1
          PS3X          45    145    45   VTAM        1        0
DSWT4391  DSWT4391      2      2     2    C-C        0        1
          SC4Y           2    102     2    C-C        1        0
DSWT3324  DSWT3324     17     17    17   VTAM        0        1
          IT1Y          17    117    17   VTAM        1        0
DSWT4781  DSWT4781      3      3     3    C-C        0        1
          SC4Z           3    103     3    C-C        1        0
DSWT3525  DSWT3525      3      3     3    C-C        0        1
          SC6Z           3    103     3    C-C        1        0
DSWT4542  DSWT4542      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT5796  DSWT5796      3      3     3    C-C        0        1
          SC2Z           3    103     3    C-C        1        0
DSWT4782  DSWT4782      3      3     3    C-C        0        1
          SC6Z           3    103     3    C-C        1        0
DSWT4633  DSWT4633      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT3655  DSWT3655     12     12    12   VTAM        0        1
          SC6U          12    112    12   VTAM        1        0
DSWT3892  DSWT3892      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT3338  DSWT3338      4      4     4   VTAM        0        1
          SC2U           4    104     4   VTAM        1        0
DSWT4681  DSWT4681      3      3     3    C-C        0        1
          SC4Z           3    103     3    C-C        1        0
DSWT4482  DSWT4482      2      2     2    C-C        0        1
          SC6Y           2    102     2    C-C        1        0
DSWT4902  DSWT4902      3      3     3    C-C        0        1
          SC2Z           3    103     3    C-C        1        0
DSWT4558  DSWT4558      3      3     3    C-C        0        1
DSWT4558  SC6Z          3    103     3    C-C        1        0
DSWT3925  DSWT3925      2      2     2    C-C        0        1
TOTAL TRAFFIC
                                                  1353     1359
```

Figure 194. MSC Traffic Report

Assessing the Effect of Link Loading

The MSC Summaries report shows you the enqueue and dequeue activity for messages that are handled by the local system but are part of the multiple system coupling traffic. The report format is illustrated in Figure 195 on page 471.

The first set of queuing counts shows how many transactions of each type were entered in the monitor interval, and how many were subsequently dequeued.

The second set of counts summarizes the total traffic for each destination name. You can distinguish the primary transactions and responses by the resource names and examine the relative servicing of the link transmissions using the difference between the enqueue and dequeue counts.

The third set of counts lists the active links by link number, and you can determine if there is a buildup on the link by the difference in the enqueue and dequeue counts.

The fourth set of counts records the traffic that is going to other systems by whatever link path. You can judge by the difference in enqueue and dequeue counts whether the overall pattern of link priorities to one or more systems is causing buildup of cross system traffic.

```
     IMS MONITOR   ****MSC SUMMARIES****              TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0178
<----SUMMARY BY INPUT NAME----->|<---SUMMARY BY DESTINATION NAME--->|<--SUMMARY BY LOGICAL LINK--->|<---SUMMARY BY DEST. SYS. ID-->

 INPUT     ENQUEUE   DEQUEUE    |    DESTIN.   ENQUEUE   DEQUEUE    |    LINK  ENQUEUE   DEQUEUE    |    DEST.  ENQUEUE   DEQUEUE
  NAME       COUNT     COUNT    |     NAME       COUNT     COUNT    |    NO.     COUNT     COUNT    |     SID     COUNT     COUNT
  ____       _____     _____    |     ____       _____     _____    |    ___     _____     _____    |     ___     _____     _____

DSWT3577         1         1    |   DSWT4358         0         1    |                               |
DSWT4048         1         1    |   DSWT5988         0         1    |                               |
DSWT5216         1         1    |   DSWT5457         0         1    |                               |
DSWT4776         1         1    |   DSWT5187         0         1    |                               |
DSWT5496         1         1    |   DSWT3312         0         2    |                               |
DSWT5277         1         1    |   DSWT5604         0         1    |                               |
DSWT5711         1         1    |   DSWT3347         0         1    |                               |
DSWT5274         1         1    |   DSWT5338         0         1    |                               |
DSWT5807         1         1    |   DSWT3268         0         1    |                               |
DSWT3685         1         1    |   DSWT3676         0         1    |                               |
DSWT6161         1         1    |   DSWT5428         0         1    |                               |
DSWT3838         1         1    |   DSWT5395         0         1    |                               |
DSWT4618         1         1    |   DSWT4168         0         1    |                               |
DSWT3903         1         1    |   DSWT5061         0         1    |                               |
DSWT5418         1         1    |   DSWT3511         0         1    |                               |
DSWT4673         1         1    |   DSWT3363         0         1    |                               |
DSWT5141         1         1    |   DSWT3674         0         1    |                               |
DSWT4391         1         1    |   DSWT4467         0         1    |                               |
DSWT3324         1         1    |   DSWT4501         0         1    |                               |
DSWT4781         1         1    |   DSWT5037         0         1    |                               |
DSWT3525         1         1    |   DSWT4298         0         1    |                               |
DSWT4542         1         1    |   DSWT5778         0         1    |                               |
DSWT5796         1         1    |   DSWT4003         0         1    |                               |
DSWT4782         1         1    |   DSWT3988         0         1    |                               |
DSWT4633         1         1    |   DSWT4217         0         1    |                               |
DSWT3655         1         1    |   DSWT6135         0         1    |                               |
DSWT3892         1         1    |   DSWT5147         0         1    |                               |
DSWT3338         1         1    |   DSWT5381         0         1    |                               |
DSWT4681         1         1    |   DSWT5593         0         1    |                               |
DSWT4482         1         1    |   DSWT3304         0         1    |                               |
DSWT4902         1         1    |   DSWT5081         0         1    |                               |
DSWT4558         1         1    |   DSWT4671         0         1    |                               |
                                |   DSWT3655         0         1    |                               |
                                |   DSWT3892         0         1    |                               |
                                |   DSWT3338         0         1    |                               |
                                |   DSWT4681         0         1    |                               |
                                |   DSWT4482         0         1    |                               |
                                |   DSWT4902         0         1    |                               |
                                |   DSWT4558         0         1    |                               |
                                |   DSWT3925         0         1    |                               |
```

Figure 195. MSC Summaries Report

Assessing Link Queuing Times

The MSC Queuing Summary report provides information about intersystem message traffic only. You can use the sample of traffic recorded in the IMS Monitor interval to examine the maximum and average time messages spend in queues waiting to be sent on active links. You can detect whether the link priorities are causing undue delay of primary messages through the intermediate system or whether there is a buildup of responses. The report shows the logical link paths for this system which is an intermediate system. Each incoming link number shows the number of messages that are queued before transmission on their specified outward bound link number. The maximum queue count is given as well as the maximum and average time on the intermediate system queues.

The report is illustrated in Figure 196 on page 472.

```
     IMS MONITOR   ****MSC QUEUING SUMMARY****        TRACE START 1993 130   5:55:15     TRACE STOP  1993 130   5:59:49  PAGE 0180
 ENQUE.....     DEQUE.....                MAX.Q        MAX.         MEAN     DIST.
LINK NO.TYPE   LINK NO.TYPE   MESSAGES   LENGTH       Q TIME       Q TIME   NUMBER

_______ ____   _______ ____   ________   ______       ______       ______   ______
    46  VTAM       46  VTAM         12        1        31468         9521     1475
    49  VTAM       49  VTAM         15        1        30235         8040     1503
    50  VTAM       50  VTAM         10        1        13042         5521     1539
    48  VTAM       48  VTAM          9        1         7730         4429     1762
    47  VTAM       47  VTAM          8        1        10035         5791     1998
TOTALS...                          54                                6967
```

Figure 196. MSC Queuing Summary Report

Extracting Multiple System Transaction Statistics

You can use the Log Transaction Analysis utility to obtain counts of the message traffic both in local systems and between systems. The transmissions over the different types of physical links can also be examined. The activity is summarized for each step of the logical link paths. You must provide IMS system log input that reflects all partner system activity, that is, sets of system logs for each MSC system. To coordinate the sets of individual system logs you use the Log Merge utility. Up to nine separate system logs can be merged; each log must be the output of a uniquely identified IMS system with MSC installed.

Controlling the Log Merge

To control the log output, you must:

- Choose the required systems that take part in the logical link paths you are examining.
- Coordinate the series of input logs for each system so that they cover a similar time span.
- Specify a start and stop time for the Log Merge utility control statements if you are to sampling the cross system processing for a particular interval.

  You can give both start date (Julian) and time of day, or just time of day. These times apply to the first system log specified by the LOG01 DD statement. Other log activity is collected if it occurs between the initial and final events present on the first log.
- Specify `MSG` to select log records that are suitable for the transaction analysis step. (ALL records is the default, but this means the DL/I activity for several systems is included in the utility input and this could cause extended processing time.)

Interpreting the Transaction Analysis Report

You can use the Log Analysis report produced by the Log Transaction Analysis utility to obtain the following statistics for individual transactions processed in any system:

- The total response time
- The time on input and output queues
- The processing time

Chapter 22, “Interpreting Statistical-Analysis and Log-Transaction Reports,” on page 491 defines the format of the detailed report records for this report, provides a list of processing type codes, and shows an illustration of the report. The absence of times for a message GU call or MPP termination in the report lines indicate an input source or intermediate system report line.

The processing type field is used to interpret the detailed report lines. The S code indicates that the line shows a send or receive event for the transaction. You can trace the progress of a cross system conversation using the codes C, D, P, X, and Y.

The report includes a column headed `SYS ID` (located after the `GU` column that indicates the message queue time). The number shown in a report line under the ID heading matches the sequence in which log input was fed to the Log Merge utility. The field corresponds to starting position 102, the 3-digit field named `SYSTEM ID`, in the detailed report records.

You can use the sort step to order the report records by system ID within transaction code, or some other convenient sequence, rather than by the default which is the overall input sequence.

Chapter 21. Interpreting //DFSSTAT Reports

The //DFSSTAT reports show you how many DB and DC calls are issued by an application program and describe buffering activity during the application's execution. The reports are written when the application program terminates.

The following topics provide additional information:

- "JCL Description for //DFSSTAT"
- "Report Descriptions for //DFSSTAT"

JCL Description for //DFSSTAT

To get the reports, you must put a //DFSSTAT DD statement in the JCL of your batch region or online dependent region. The following is an example of a //DFSSTAT DD statement.

```
//DFSSTAT DD   SYSOUT=A
```

Recommendation: Although it is supported, do not include the //DFSSTAT DD statement in the JCL for an MPP region. If you do not include the //DFSSTAT DD statement, you avoid the overhead and large amount of output that results from creating one set of reports each time a short-running MPP terminates.

Report Descriptions for //DFSSTAT

The //DFSSTAT reports are as follows:

- PST-Accounting report
- VSAM-Buffer-Pool report (for batch regions only)
- OSAM-Buffer-Pool report (for batch regions only)
- Sequential-Buffering-Summary report
- Sequential-Buffering-Detail report

PST-Accounting Report

This report shows how many DB and DC calls are issued by an application program.

Fields in the Report

Figure 197 on page 476 is an example of a PST-Accounting report and shows the names of each field. Each field in this report represents one type of DB or DC call. For example, the DB GU CALLS field shows how many database Get Unique calls were issued by the application.

```
            *** PST ACCOUNTING STATISTICS ***
DB GU CALLS                 2
DB GN CALLS                 2
DB GNP CALLS                1
DB GHU CALLS                1
DB GHN CALLS                1
DB GHNP CALLS               1
DB ISRT CALLS               2
DB DLET CALLS               1
DB REPL CALLS               1
DB CALLS (TOTAL)           12
DB DEQ CALLS                1
MSG GU CALLS                2
MSG GN CALLS                2
MSG CHNG CALLS              4
MSG ISRT CALLS              8
MSG PURGE CALLS             4
MSG CMD CALLS               1
MSG GCMD CALLS              1
MSG AUTH CALLS              1
MSG SETO CALLS              4
SYS APSB CALLS              0
SYS DPSB CALLS              0
SYS GMSG CALLS              2
SYS ICMD CALLS              1
SYS RCMD CALLS              2
SYS CHKP CALLS              0
SYS XRST CALLS              0
SYS ROLB CALLS              1
SYS ROLS CALLS              2
SYS SETS CALLS              1
SYS SETU CALLS              1
SYS INIT CALLS              1
SYS INQY CALLS              3
SYS LOG CALLS               1
```

Figure 197. PST-Accounting Report

VSAM-Buffer-Pool Report

The VSAM-Buffer-Pool report describes VSAM buffer pool activity during the execution of an application program. A separate report is written for each VSAM sub-pool. The last VSAM-Buffer-Pool report summarizes the buffering activity in all the VSAM sub-pools used by the application.

This report is written only for applications that you run in batch regions.

Fields in the Report

Figure 198 on page 477 is an example of a VSAM-Buffer-Pool report. This report is identical to the VSAM-Buffer-Pool report written by the DB monitor, with the following exceptions:

- Although the field names in the DB Monitor's VSAM Buffer Pool report are preceded by "NUMBER OF", the fields in both reports have the same meaning.
- The //DFSSTAT VSAM-Buffer-Pool report does not keep track of the start trace and end trace times. This is unnecessary because information is always gathered for the //DFSSTAT reports from the beginning to the ending of the application's execution.
- The //DFSSTAT VSAM-Buffer-Pool report contains a "TOTAL I/O OPERATIONS" field, which is the sum of the following:

- The number of times a CI was read into the buffer from the database (CONTROL INTERVAL READ FROM EXTERNAL STORAGE field in the report)
- The number of times a buffer was written to the database (VSAM WRITES INITIATED BY IMS field in the report)
- The number of times a buffer was written to the database so a new CI could be read into the buffer (VSAM WRITES TO MAKE SPACE IN THE POOL field in the report).
- The //DFSSTAT VSAM-Buffer-Pool report includes a summary report. The summary report is preceded by SUBPOOL BUFFER SIZE=ALL. It contains a summary of read and write information for all VSAM Buffer Pool reports.

The fields that represent I/O operations are highlighted on the left by an asterisk (*).

Related Reading: See *IMS Version 9: Utilities Reference: Database and Transaction Manager* for a description of the various fields in the report.

Using the Report

The primary use of the VSAM-Buffer-Pool report, an example is shown in Figure 198, is to see how many I/O operations were issued in each VSAM sub-pool.

```
                    *** VSAM BUFFER POOL STATISTICS ***
 FIX INDEX/BLOCK/DATA                                    N/Y/N
 SHARED RESOURCE POOL ID                                  VPL1
 SHARED RESOURCE POOL TYPE                                   D
 SUBPOOL BUFFER SIZE                                     4,096
 TOTAL BUFFERS IN SUBPOOL                                1,000
 TOTAL HIPERSPACE BUFFERS IN SUBPOOL                        50


 RETRIEVE BY RBA CALLS                                     370
 RETRIEVE BY KEY CALLS                                  187583
 LOGICAL RECORDS INSERTED INTO ESDS                        310
 LOGICAL RECORDS INSERTED INTO KSDS                       9823
 LOGICAL RECORDS ALTERED IN THIS SUBPOOL                     0
 TIMES BACKGROUND WRITE FUNCTION INVOKED                     0
 SYNCHRONIZATION CALLS RECEIVED                          29923
 PERM WRT ERROR BUFFS NOW IN THE SUBPOOL                     0
 LARGEST NBR OF PERM ERR BUFFS EVEN IN THE SUBPL             0
 VSAM GET CALLS ISSUED                                       0
 VSAM SCHBFR CALLS ISSUED                               189290
 CONTROL INTERVAL REQUESTED ALREADY IN POOL                  0
*CONTROL INTERVAL READ FROM EXTERNAL STORAGE             51238
*VSAM WRITES INITIATED BY IMS                           138637
*VSAM WRITES TO MAKE SPACE IN THE POOL                    9288
 VSAM READS FROM HIPERSPACE BUFFERS                          0
 VSAM WRITES FROM HIPERSPACE BUFFERS                         0
 FAILED VSAM READS FROM HIPERSPACE BUFFERS                   0
 FAILED VSAM WRITES TO HIPERSPACE BUFFERS                    0

*TOTAL I/O OPERATIONS                                   199163
```

Figure 198. VSAM-Buffer-Pool Report

OSAM-Buffer-Pool Report

The OSAM-Buffer-Pool report describes the OSAM buffer pool activity during an application's execution. This report is only written for programs running in batch regions.

Fields in the Report

Figure 199 on page 479 is an example of an OSAM-Buffer-Pool report.

The OSAM-Buffer-Pool report is identical to the Database-Buffer-Pool report written by the DB monitor, with the following exceptions:

- The field names in the IMS Monitor's Database-Buffer-Pool report are preceded by "NUMBER OF", although the fields have the same meaning in both reports.
- The //DFSSTAT OSAM-Buffer-Pool report does not keep track of the start trace and end trace times. This is unnecessary because information is always gathered for the //DFSSTAT reports from the beginning to the ending of the application's execution.
- In addition, the //DFSSTAT OSAM-Buffer-Pool report contains a "TOTAL I/O OPERATIONS" field, which equals the sum of the following fields:
  - READ REQUESTS ISSUED
  - OSAM WRITES ISSUED
  - QUEUED WRITES ISSUED
  - FORMAT LOGICAL CYLINDER REQUESTS
  - BISAM READS OR QISAM SETLS.

  These fields represent I/O operations and are highlighted on the left by an asterisk (*).

Related Reading: Refer to *IMS Version 9: Utilities Reference: Database and Transaction Manager* for a description of the various fields in the OSAM-Buffer-Pool Report.

Using the Report

The primary use of the OSAM-Buffer-Pool report, an example is shown in Figure 199 on page 479, is to see how many OSAM I/O operations were issued. This report does not, however, show Sequential Buffering (SB) related information.

```
   *** OSAM DATA BASE BUFFER POOL STATISTICS ***
 FIX BLOCK DATA                                  Y/Y
 SUBPOOL ID                                     O04K
 SUBPOOL BUFFER SIZE                            4096
 TOTAL BUFFERS IN SUBPOOL                       1000


 LOCATE-TYPE CALLS                           1765296
 REQUESTS TO CREATE NEW BLOCKS                     0
 BUFFER ALTER CALLS                           340800
 PURGE CALLS                                   39371
 LOCATE-TYPE CALLS, DATA ALREADY IN SUBPOOL   1370897
 BUFFERS SEARCHED BY ALL LOCATE-TYPE CALLS    1987604
*READ I/O REQUESTS                            375355
*SINGLE BLOCK WRITES BY BUFFER STEAL RTN            0
*BLOCKS WRITTEN BY PURGE                      150284
 TOTAL NBR OF I/O ERRORS FOR THIS SUBPOOL           0
 BUFFERS LOCKED DUE TO WRITE ERRORS                 0
 LOCATE CALLS WAITED DUE TO BUSY ID              1431
 LOCATE CALLS WAITED DUE TO BUFR BUSY WRITE         0
 LOCATE CALLS WAITED DUE TO BUFR BUSY READ          0
 BUFR STEAL/PURGE WAITED FOR OWNERSHIP RLSE       296
 BUFFER STEAL REQUEST WAITED FOR BUFFERS            0

*TOTAL I/O OPERATIONS                         525639
```

Figure 199. OSAM-Buffer-Pool Report

Sequential-Buffering-Summary Report

The Sequential-Buffering-Summary report provides an overview of SB-related information for the application. (VSAM-related information is not included.)

Sequential-Buffering Summary Report Fields

Figure 200 on page 481 is an example of a Sequential-Buffering-Summary report.

The first part of this report shows why Sequential Buffering was or was not used. This part of the report tells you whether:

- A SBONLINE control card was provided in DFSVSMxx (this applies only to IMS DC environments).
- A /STOP SB command was in effect when the application program started (this applies only to IMS DC environments).
- The SB Initialization Exit Routine (DFSSBUX0) disallowed use of SB.
- The SB Initialization Exit Routine (DFSSBUX0) requested conditional activation of SB by default.
- At least one SB= keyword was provided during PSBGEN.
- The //DFSCTL file contained at least one SBPARM control statement that applied to the application program.
- SBPARM control cards have been read. If the answer is Yes, the following statistics indicate what SBPARM keywords were used. This can be helpful in determining why sequential buffering was or was not used for the application program.
- At least one PSB= keyword was specified on an SBPARM control card and it matched the PSB used by the application.

- At least one DB= keyword was specified on an SBPARM control card where the PSB matched or was not specified, and the database matched one used by the application.
- At least one PCB= keyword was specified on an SBPARM control card where the PSB and DB matched or were not specified, and the PCB name matched one used by the application.
- At least one DD= keyword was specified on an SBPARM control card where the PSB, DB, and PSB matched or were not specified, and the DDNAME matched one used by the application.
- Whether SBPARM control cards have been read. If the answer is "yes," the following statistics indicate what SBPARM keywords were used. This is helpful in determining why sequential buffering was or was not used for the application program.
- At least one PSB= keyword was specified on a SBPARM control card and it matched the PSB used by the application.

The other fields in the report are as follows:

NUMBER OF SEARCH REQUESTS ISSUED BY THE OSAM BH
This field shows you how many times the OSAM buffer handler asked the SB buffer handler to search the SB buffer pools for a specific OSAM block.

The value in this field is equal to the number of OSAM random read I/O operations that would have been issued without SB.

NUMBER OF READ I/O
These fields show you the number of OSAM random and sequential read I/O operations it took to satisfy requests made by the application program. The sum of these two numbers is the total number of OSAM read I/O operations issued on behalf of the application. You can subtract this sum from the NUMBER OF SEARCH REQUESTS ISSUED BY THE OSAM BH field to calculate how many read I/O operations you saved by using SB.

NUMBER OF BLOCKS READ
These fields tell you how many OSAM data set blocks were read to satisfy requests from the application program. These fields show you:

- The total number of blocks read
- The number and percentage of blocks read with a random read
- The number and percentage of blocks read with a sequential read

If the percentage of blocks read with a sequential read is high, SB probably helped reduce the elapsed time of the application program.

PERCENT READ PER SEARCH REQUEST
This field shows you the number of read I/O operations issued by the SB buffer handler expressed as a percentage of the number of times the OSAM buffer handler asked the SB buffer handler to search for a block.

A low percentage indicates that many of the search requests were satisfied without issuing an I/O operation. Therefore, a low number in this field shows that SB probably helped reduce the elapsed time of the application program.

NUMBER OF SEQUENTIAL I/O ERRORS
This field tells you the number of sequential reads that resulted in I/O errors. When an I/O error is detected during a sequential read, IMS increments this field and marks the 10 SB buffers involved in the read as invalid. Then IMS issues a random read for the block that was requested by the OSAM buffer handler.

Using the Report

From an SB Summary report, an example is shown in Figure 200, you can determine if the application benefited from the use of SB. When using this report, pay particular attention to these fields:

- NBR BLOCKS READ SEQUENTIALLY and PCT OF TOTAL
- PERCENT READ PER SEARCH REQUEST

```
*** SEQUENTIAL BUFFERING SUMMARY FOR THE APPLICATION ***

DFSSBUX0 DISALLOWED USAGE OF SB:                       NO
DFSSBUX0 REQUESTED CONDITIONAL SB ACTIVATION:          NO
AT LEAST ONE SB= KEYWORD IN PSB:                      YES
AT LEAST ONE SBPARM CONTROL STMT FOR APPLICATION:      NO
SBPARM CONTROL CARD(S) READ FROM //DFSCTL:            YES
AT LEAST ONE SBPARM PSB= SPECIFIED THAT MATCHED PSB: YES
AT LEAST ONE SBPARM DB= SPECIFIED THAT MATCHED DB:   YES
AT LEAST ONE SBPARM PCB= SPECIFIED THAT MATCHED PCB:  NO
AT LEAST ONE SBPARM DD= SPECIFIED THAT MATCHED DD:    NO

NUMBER OF SEARCH REQUESTS ISSUED BY OSAM BH:
      SEARCH                                       2,213
NUMBER OF READ I/O:
      RANDOM READ                                    686
      SEQUENTIAL READ                                652
NUMBER OF BLOCKS READ:
      TOTAL NUMBER BLOCKS READ                     7,206
      NBR BLOCKS READ AT RANDOM                      686        PCT OF TOTAL:
      NBR BLOCKS READ SEQUENTIALLY                 6,520        PCT OF TOTAL:  9
PERCENT READ PER SEARCH REQUEST                    60.46
NUMBER OF SEQUENTIAL I/O ERRORS                        0
```

Figure 200. Sequential-Buffering-Summary Report

Sequential-Buffering-Detail Report

This report gives you detailed information about how SB was used for a particular SB buffer pool. A separate report is created for each SB buffer pool used by the application program.

Each report consists of three pages, A, B, and C. Summary information is contained on page A. More detailed information is found on pages B and C.

Each of the following sections contains an example of the relevant page (A, B or C) of the Sequential-Buffering-Detail report.

Fields on Page A

Figure 201 on page 482 shows an example of page A of the report.

PST-Accounting Report

```
//DFSSTAT STATISTICS FOR: JOB=OSBTC01   STEP=STEP1   .          PGM=DFSDDLT0  PSB=PBVDSALR  DATE=93.058  TIME=09.39
-------------------------------------------------------------------------------------------------------------------------
                       *** SB DETAIL STATISTICS   (PAGE A) ***
PSB                 PBVDSALR
DB                  DBOVLFPC
PCB
DB-PCB NBR                 1
DSG-CB NBR                 1
DD                  VLOSAM01
DB-ORG              HDAM
DD-TYPE             *PSDATA
NBR OF BUFSETS             4
COMPARE-OPTION IS ACTIVE
** NUMBER OF SEARCH REQUESTS ISSUED BY OSAM BH:
      SEARCH                                    2,213
** NUMBER OF READ I/O:
      TOTAL                                     1,338
      RANDOM READ                                 686
      SYNCHRONOUS SEQUENTIAL READ                 555
      OVERLAPPED  SEQUENTIAL READ                  97
** NUMBER OF BLOCKS READ:
      TOTAL                                     7,206
      RANDOM READ                                 686        PCT OF TOTAL:   9.51
      SYNCHRONOUS SEQUENTIAL READ               5,550        PCT OF TOTAL:  77.01
      OVERLAPPED  SEQUENTIAL READ                 970        PCT OF TOTAL:  13.46
** AVERAGE I/O WAIT TIMES (MILLIS):
      RANDOM READ                               15.70
      SYNCHRONOUS SEQUENTIAL READ               18.03
      OVERLAPPED  SEQUENTIAL READ                 .26
```

Figure 201. Sequential-Buffering-Detail Report Page A

You can use the first section of this page to identify the SB buffer pool, database PCB, and DD name this report applies to. There can be more than one SB buffer pool (and, thus, more than one report) created for a particular database PCB and DD name. This can happen if the PCB is involved in a logical relationship.

This section contains the following information:

- The PSB name.
- The DBD name (as coded in the PCB macro during PSBGEN).
- The PCB label (as coded in the PCB macro during PSBGEN).
- The relative number of the database PCB within the PSB.
- A unique identifier of the data set group control block within the database PCB. (You can use this number to uniquely identify the SB buffer pool when more than one SB buffer pool has been created for the same PCB and DD name.)
- The DD name.
- The type of database organization (HDAM, HIDAM, PHDAM, PHIDAM, or HISAM).
- The type of database data set. This can be one of three values:
  - *INDX indicates this report applies to a data set used as an index.
  - *PSDATA indicates this report applies to a data set containing data accessed according to its primary sequence.
  - *SSDATA indicates this report applies to a data set containing data accessed according to a secondary index sequence or by crossing a logical relationship.
- The number of buffer sets in the SB buffer pool. The default number of buffer sets is four. You might have changed this default, however, with a SBPARM control statement or in the SB Initialization Exit routine.

NUMBER OF SEARCH REQUESTS ISSUED BY OSAM BH
This field shows you the number of OSAM random read I/O operations that would have been issued without using SB.

NUMBER OF READ I/O

These fields show you the number of read I/O operations that were actually issued in this SB buffer pool. The fields tell you:

- The total number of OSAM read I/O operations
- The number of random reads
- The number of synchronous sequential reads
- The number of overlapped (asynchronous) sequential reads

You can use these fields to calculate the percentage of each of the three types of read I/O operations that were used for this database PCB and DD name. You can also subtract the total number of OSAM read I/O operations from the NUMBER OF SEARCH REQUESTS ISSUED BY OSAM BH field to determine the number of read I/O operations you saved by using SB.

NUMBER OF BLOCKS READ

These fields show you how many blocks were read by each type of read I/O operation. The fields tell you:

- The total number of blocks read
- The number and percentage of blocks read by random reads
- The number and percentage of blocks read by synchronous sequential reads
- The number and percentage of blocks read by overlapped (asynchronous) sequential reads

A high percentage of blocks read with sequential reads tells you that SB probably helped the application program run faster, at least while processing this database PCB and data set.

A high percentage of blocks read with random reads, however, might indicate:

- A large amount of random processing by the application program
- The OSAM data set associated with this database PCB needs reorganizing

If many blocks were read with random reads, and if the program was processing the database sequentially, you can sometimes get better buffering performance by increasing the number of buffer sets (for example, increase the value of the BUFSETS parameter on the SBPARM control statement in //DFSCTL). After increasing the number of buffer sets, observe how the number reported in the NUMBER OF READ I/O field changes the next time the application is executed.

A small percentage of blocks read at random sometimes indicates that you can reduce the number of buffer sets to save virtual storage space.

AVERAGE I/O WAIT TIMES (MILLIS)

These fields tell you the average I/O wait times for each of the three types of read I/O operations. These times show the average time the application program waited for a read I/O operation to complete before it could process the data being read.

The times in these fields are in milliseconds. A millisecond is one thousandth of a second (in other words, 50 milliseconds equals 0.050 seconds).

These fields show you:

- The average I/O wait time for random reads
- The average I/O wait time for synchronous sequential reads
- The average I/O wait time for overlapped (asynchronous) sequential reads

These times are only measured when SB is active or IMS is monitoring the I/O reference pattern.

Fields on Page B

Figure 202 shows an example of page B of the report.

```
-------------------------------------------------------------------------------------------
                      *** SB DETAIL STATISTICS: REFERENCE STATISTICS   (PAGE B) ***
** REFERENCES IN BUFFER-SETS:
      RATIO                                .23
** REFERENCES IN RANDOM SRAN CBS:
      RATIO                                .20
** RANDOM SRAN CBS WHICH HAVE BEEN CONVERTED:
      NUMBER                                0
      PCT OF STOLEN RANDOM SRAN            .00

*****          DISTRIBUTION OF REFERENCES IN BUFFER-SETS          *****
-----------------------------------------------------------------------
REFERENCE COUNT   NBR OF OCCURRENCES   PCT OF OCCURRENCES   ACCUMUL. PCT
              0                    3                  .46           .46
              1                  551                84.50         84.96
              2                    0                  .00         84.96
              3                    0                  .00         84.96
              4                    0                  .00         84.96
              5                    0                  .00         84.96
              6                    0                  .00         84.96
              7                    0                  .00         84.96
              8                    0                  .00         84.96
              9                    4                  .61         85.58
         =>  10                   94                14.41        100.00

*****        DISTRIBUTION OF REFERENCES IN RANDOM SRAN CBS        *****
-----------------------------------------------------------------------
REFERENCE COUNT   NBR OF OCCURRENCES   PCT OF OCCURRENCES   ACCUMUL. PCT
              0                    0                  .00           .00
              1                    0                  .00           .00
              2                    1               100.00        100.00
```

Figure 202. Sequential-Buffering-Detail Report Page B

This page can be used to evaluate the efficiency of the SB algorithm that monitored the I/O reference pattern for this SB buffer pool. By analyzing this page, you can answer these questions:

- How efficient were the decisions to issue sequential reads? This question can be answered by the REFERENCES IN BUFFER SETS field.
- How efficient were the decisions to issue random reads? This question can be answered by the REFERENCES IN RANDOM SRAN CBS field and the RANDOM SRAN CBS WHICH HAVE BEEN CONVERTED field.

The fields on Page B reflect buffering activity when SB was active. Buffering activity when IMS was only monitoring the I/O reference pattern is not included.

REFERENCES IN BUFFER SETS

This field shows you how many times blocks read with a sequential read were referenced by the OSAM buffer handler. This ratio is calculated as follows:

The number of references in buffer sets divided by the number of blocks read by sequential read.

For example, a ratio of 1.00 means that, on the average, each block read by a sequential read was referenced once. A ratio of 0.50 means that, on the average, only half the blocks read by a sequential read were referenced once.

In general, a high ratio (for example, 0.85) shows you that the decisions to issue sequential reads were efficient and probably helped reduce the execution

time of the application. A low ratio (for example, 0.30) shows you that the benefit of issuing sequential reads was smaller because many of the blocks read were never referenced.

REFERENCES IN RANDOM SRAN CBS

This field shows you the effectiveness of the decisions to issue random reads. To understand what this ratio means, you must first understand how the SB buffer handler uses control blocks to track the I/O reference pattern.

The SB buffer handler uses a control block called SB range (SRAN) to track the I/O reference pattern within a range of 10 consecutive blocks. Each SRAN has a reference counter that shows how many times the OSAM buffer handler requested a block contained in the set of 10 blocks tracked by the SRAN.

There are two types of SRAN control blocks. One type, called a *sequential* SRAN, maintains counts for 10 consecutive blocks that have been read with a sequential read. A second type, called a *random* SRAN, maintains counts for 10 consecutive blocks that have been referenced in a random pattern. There is one sequential SRAN for each buffer set in an SB buffer pool; the number of random SRANs is twice the number of sequential SRANs.

The SRANs are chained together on a “use chain,” that is, they are chained together in the order in which they have been most or least recently used. Each type of SRAN has its own use chain. Most recently used SRANs are at the top of the use chain; least recently used SRANs are at the bottom. Whenever a SRAN is needed to track a set of blocks that are not currently being tracked, the SB buffer handler selects a SRAN from the bottom of the use chain. This is because ranges of consecutive blocks that have not been referenced recently are less likely to be referenced again in the near future.

Each time a random SRAN is reused, the reference count maintained in the SRAN is recorded for later use. When the application program terminates, these reference counts are used to calculate the number in this field. The number is calculated as follows:

Ratio = X / (Y * 10)

where,

X Total number of random references in random SRANs (this number is usually equal or close to the number of random reads in the sets of blocks tracked by random SRANs)

Y Total number of reused random SRANs

A low ratio (for example, 0.15) in this field means that on the average, the SB buffer handler correctly recognized random I/O reference patterns. A ratio of 0.15 means that the SB buffer handler issued an average of 1.5 random reads for blocks tracked by a random SRAN. Issuing 1.5 random reads for a set of 10 consecutive blocks is normally more efficient then issuing one sequential read for the 10 consecutive blocks.

A high ratio (for example, 0.50) in this field probably indicates that the SB buffer handler often mistook sequential reference patterns as random reference patterns. A ratio of 0.50 means that the SB buffer handler issued an average of 5 random reads for blocks tracked by a random SRAN. Issuing 5 random reads for a set of 10 consecutive blocks is normally less efficient than issuing one sequential read for the 10 consecutive blocks.

RANDOM SRAN CBS WHICH HAVE BEEN CONVERTED

These fields are another measurement of the SB buffer handler's effectiveness in analyzing the I/O reference patterns.

Sometimes the SB buffer handler interprets a reference to a set of consecutive blocks as a random pattern, then, after some additional references, detects that the set of blocks is actually being referenced sequentially. In this case, the SB buffer handler first issues several random reads in a set of consecutive blocks and later issues a sequential read for the same set of blocks. When this occurs, the random SRAN that tracks the set of blocks is converted to a sequential SRAN. If the SB buffer handler had originally read the set of blocks with a sequential read, the cost of issuing several random reads would have been avoided.

The fields in this section are:

NUMBER

This tells you how many times random SRANs were converted to sequential SRANs during the application program's execution.

PCT OF STOLEN RANDOM SRAN

The value in this field expresses the number of converted SRANs as a percentage of the number of times the SB buffer handler had to acquire a random SRAN from the use chain. A high percentage (for example, 40 percent) probably indicates that the SB buffer handler often mistook a sequential reference pattern as random reference pattern.

DISTRIBUTION OF REFERENCES IN BUFFER SETS

This table shows you more detailed information about the ratio reported in the REFERENCES IN BUFFER SETS field.

For example, the REFERENCES IN BUFFER SETS field might indicate that 80 percent (0.80) of the blocks in the SB buffer sets were referenced. What does this mean? It could mean that 20 percent of the time none of the blocks in a buffer set were referenced. Or instead, it could mean that 100 percent of the time only 8 out of 10 blocks in the buffer sets were referenced. You can answer this question by analyzing this table.

The fields in this table are:

REFERENCE COUNT

This column lists the number of references to blocks in a buffer set. A zero in this column means that no references were made to blocks in a buffer set, a one means that one reference was made, and so on. The "=> 10" in the last row of this column means that 10 or more references were made.

NBR OF OCCURRENCES

This column shows you how many buffer sets were referenced the number of times shown in the REFERENCE COUNT column. For example, in Figure 202 on page 484, the first number in this column is 3, which says that 3 buffer sets were never referenced. The second number says that 551 buffer sets were referenced once.

PCT OF OCCURRENCES

This column shows you the value in the NBR OF OCCURRENCES column expressed as a percentage of the number of times buffer sets were reused. For example, in Figure 202 on page 484, the first number in this column is 0.46, which says that 0.46 percent of the reused buffer sets were never referenced. The second number says that 84.50 percent of the reused buffer sets were referenced once.

ACCUMUL. PCT
This column shows you the accumulated PCT OF OCCURRENCES from zero through the current reference count. For example, in Figure 202 on page 484, the third number in this column is 84.96, which says that 84.96 percent of the reused buffer sets were referenced two or less times.

DISTRIBUTION OF REFERENCES IN RANDOM SRAN CBS
This table shows you more detailed information about the ratio reported in the REFERENCES IN RANDOM SRAN CBS field. The table is similar to the DISTRIBUTION OF REFERENCES IN BUFFER SETS table, except that it shows information about references tracked by random SRAN control blocks.

REFERENCE COUNT
This column lists the number of references to blocks tracked by random SRANs. A zero in this column means that no references were made and, therefore, no random reads were issued for blocks tracked by a random SRAN. A “one” means that one reference was made to blocks tracked by a random SRAN (on the average, one reference for every tenth block tracked by the random SRAN).

NBR OF OCCURRENCES
This column shows you how many random SRANs were referenced the number of times shown in the REFERENCE COUNT column.

PCT OF OCCURRENCES
This column shows you the NBR OF OCCURRENCES expressed as a percentage of the number of times that random SRANs were reused.

ACCUMUL. PCT
This column shows you the accumulated PCT OF OCCURRENCES from zero through the current reference count.

Fields on Page C

Figure 203 shows an example of page C of the report.

```
//DFSSTAT STATISTICS FOR: JOB=OSBTC01   STEP=STEP1   .          PGM=DFSDDLT0  PSB=PBVDSALR  DATE=93.058  TIME=09.39
------------------------------------------------------------------------------------------------------------------------
                      *** SB DETAIL STATISTICS: INTERNAL COUNTERS AND VALUES    (PAGE C) ***
** DEACTIVATIONS:
      NBR OF SB-DEACTIVATION                              1
      NBR OF MONITORING-DEACTIVATION                      0
** RESULTS OF EVALUATION OF SEQUENTIALITY:
      NBR POSITIVE RESULTS                                3
      NBR NEGATIVE RESULTS                                1
** RESULTS OF EVALUATION OF ACTIVITY RATE:
      NBR POSITIVE RESULTS                                4
      NBR NEGATIVE RESULTS                                0
** NBR RANDOM READ:
      DURING SEQUENTIAL BUFFERING PHASES                 27
      DURING "MONITORING-ONLY" PHASES                   659
      WHILE NOT MONITORING REFERENCE PATTERN              0
** NBR RANDOM READS WITH SEQUENTIAL REFERENCE PATTERN:
      ACCESS TO INVALID BUFFERS                          25
      ACCESS AT DATA SET END                              2
** NBR OF BUFFERING POSITIONS:                        2,213
** INTERNAL SB-ALGORITHM VALUES:
      SDSGBPTR: BLOCKS PER TRACK                         31
      SDSGNBRB: BLOCKS PER BUFSET                        10
      SDSGSCST: RELATIVE SEQ I/O COSTS                 1.36
      SDSGSINB: SIZE OF NEIGHBORHOOD                      2
      SDSGTHR1: THRESHOLD CURRENT+1                       2
      SDSGTHR2: THRESHOLD OVERLAP                         3
      SDSGTHR3: THRESHOLD NEIGBH                         11
```

Figure 203. Sequential-Buffering-Detail Report Page C

Page C consists of the following sections:

DEACTIVATIONS

The fields in this section are:

NBR OF SB DEACTIVATION

This field shows how many times SB was deactivated.

NBR OF MONITORING DEACTIVATION

This field shows how many times I/O reference monitoring was deactivated.

Deactivation of I/O reference monitoring can occur for one of two reasons:

- If several consecutive periodical evaluations of the buffering process show that it is not worthwhile to use SB
- If you set a limit on the SB buffer space by specifying the MAXSB keyword in the SBONLINE control statement. The use of SB is restricted when this limit is reached.

RESULTS OF EVALUATION OF SEQUENTIALITY

This section and the next section, RESULTS OF EVALUATION OF ACTIVITY RATE, help explain why SB was deactivated (or was not activated) during the application program's execution.

The decision to activate and deactivate SB is made by a periodical evaluation of the buffering process for a particular DB-PCB/DSG control block pair. The evaluation is based on the following criteria:

- Sequentiality
- Activity rate

If the results for both tests are positive (in other words, if the results of both tests recommend use of SB), IMS will activate SB (if not active) or will continue to use SB. If at least one of the test results is negative, then IMS will deactivate SB (if active) or will continue not to use SB. After several decisions not to use SB, IMS can also deactivate monitoring of the I/O reference pattern.

The fields in this section are:

NBR POSITIVE RESULTS

This field shows you how many times periodical evaluation of the I/O reference pattern detected enough of a sequential reference pattern to warrant use of SB.

NBR NEGATIVE RESULTS

This field shows you how many times periodical evaluation of the I/O reference pattern did not detect enough of a sequential reference pattern to warrant use of SB.

RESULTS OF EVALUATION OF ACTIVITY RATE

The fields in this section are:

NBR POSITIVE RESULTS

This shows you how many times periodical evaluation detected an I/O activity rate high enough to warrant use of SB.

NBR NEGATIVE RESULTS

This shows how many times periodical evaluation determined that the I/O activity rate was not high enough to warrant use of SB.

NBR RANDOM READ

This section shows you how many random reads were issued during each of the following types of buffering phases:

DURING SEQUENTIAL BUFFERING PHASES
This field shows you how many random reads were issued while SB was active.

DURING "MONITORING ONLY" PHASES
This field shows you how many random reads were issued while SB was not active and IMS was still monitoring the I/O reference pattern.

WHILE NOT MONITORING REFERENCE PATTERN
This field shows you how many random reads were issued while SB was not active and IMS was not monitoring the I/O reference pattern.

NBR RANDOM READS WITH SEQUENTIAL REFERENCE PATTERN
This section shows you how many times random reads were issued even though the I/O reference pattern was sequential. These counters are updated only when SB is active.

The fields in this section are:

ACCESS TO INVALID BUFFERS
This field shows how many times a random read was issued because the contents of an SB buffer was invalid and could not be used. Some possible reasons for marking an SB buffer invalid are:

- Your IMS system is running in a block-level sharing environment. In a block-level sharing environment, more than one IMS system can read from and write to the same database. For example, if IMS system "A" reads a block into a buffer and IMS system "B" updates that block while the block is still in system "A's" buffer, system "A's" buffer will be marked as invalid. For more information on block-level sharing, see *IMS Version 9: Administration Guide: System*.
- The activation and deactivation of SB during periodical evaluations marks SB buffers as invalid.
- A block was being written by another online application in the same IMS subsystem at the same time the SB buffer handler was reading it.
- The SB buffer was marked invalid because of I/O errors.

ACCESS AT DATA SET END
This field shows how many times the SB buffer handler issued a random read because the set of 10 blocks containing the referenced block was not completely formatted. SB never issues a sequential read at the end of a data set if the last set of consecutive blocks is not completely formatted.

NBR OF BUFFERING POSITIONS
This field shows how many times the SB buffer handler assumed the application program issued a DL/I call requesting a new position in the database. For example, most `GU` calls qualified on the key field of a root segment other than the current root segment will cause this counter to be incremented. This counter is maintained only while SB is active and IMS is monitoring the I/O reference pattern.

A high value in this field can indicate a large amount of logical random processing by the application. If other fields seem to indicate that the application did not benefit from SB, this field can explain why.

INTERNAL SB ALGORITHM VALUES
This section shows the values of internal counters. They are included to help IMS development during SB problem determination.

Chapter 22. Interpreting Statistical-Analysis and Log-Transaction Reports

IMS provides two utilities that extract data from IMS system logs:

- The Statistical Analysis utility produces summary reports of message activity and reports for lines and terminals. For more information see Chapter 17, “Statistical Analysis Utility (DFSISTS0),” on page 359.
- The Log Transaction Analysis utility gives detailed information of individual transaction and processing activities. For more information see Chapter 16, “Log Transaction Analysis Utility (DFSILTA0),” on page 353.

The following topics provide additional information:

Statistical Analysis Utility Reports

The input data for the Statistics Analysis utility is a set of IMS log data sets, or user data sets created by the Log Archive utility. Each input data set can consist of multiple volumes. Several data sets can be concatenated. The utility uses two passes, each with an edit and a z/OS sort operation. Multiple intermediate tape volumes are usually produced.

Restriction: You cannot use system log output from a batch system.

You can use the Transaction Analysis utility to obtain new system logs with reduced content to save processing time through the sort steps. Another savings in execution is achieved by specifying the `NOTXT` option on the `DFSISTS0 EXEC` statement. This option excludes the message text from the records that are subsequently sorted and cumulated.

Another parameter in this EXEC statement specifies the suffix value for the nucleus. If your system logs were from an execution of the online IMS system that used a different nucleus from the default 0, you must give this suffix value. Do not concatenate system log data sets from different nucleus executions.

The Statistical Analysis utility has five control statements you can use to select a subset of transaction activity.

Transaction code control statement
: You can use this control statement to select a specific transaction code or groups of transaction codes. For more information see “Transaction Code Control Statement” on page 374.

Symbolic terminal name control statement
: You can use this control statement to specify the LTERM name or a generic name. For example, L3270M selects all messages originating from or

directed to that LTERM. A generic name of L3270* could select L3270M and L3270B messages, the comparison being based on the characters preceding the *.

You can further qualify the output LTERM so that only messages to a given symbolic name resulting from the input LTERM specified are selected. For more information see “Symbolic Terminal Name Control Statement” on page 374.

Hardware terminal address control statement

This control is similar to the symbolic terminal name control statement, except that you specify the line number and relative terminal number assigned to the physical terminal by system definition. Again, you can specify the output address as a further qualifier. If an output message was queued but not sent, it is not selected.

Related Reading: See “Hardware Terminal Address Control Statement” on page 375 for more information.

VTAM terminal name control statement

This control is similar to the symbolic terminal name control statement, except that you specify the node name for the physical terminal. Again, you can specify the output address as a further qualifier. If an output message was queued but not sent, it is not selected.

Related Reading: See “VTAM Terminal Name Control Statement” on page 375 for more information.

Time control statement

You can specify an interval as a criterion for selection. You give the start and stop times in the form YYDDD and HHMM (Julian day and clock time in minutes). This range criterion is applied to all messages selected by transaction code and terminal specifications.

Related Reading: See “Time Control Statement” on page 375 for more information.

If you anticipate non-printable characters in the message text, you can specify they be printed in hexadecimal format (first character above the second). Otherwise, the characters appear as blanks.

Calculating Transaction Loads

There are two reports produced by the Statistical Analysis utility that summarize the distribution of transaction activity across a 24-hour day. Input and output message distributions are separately tabulated for each transaction code and for each device. A further report shows the response times for each transaction type expressed as percentiles. The reported data is dependent on the selection of system log data that makes up the utility input. The scope of the report can be further limited by selecting a subset of transactions and line traffic as well as the reporting interval.

Figure 204 on page 493 shows the format of the Line and Terminal report. For each device on a line the LTERM name is given and a pair of rows of results for send and receive activity is given. The “Total Messages” column is followed by the total and average size of the messages in bytes. A series of hourly intervals divides the 24-hour day and counts of the transaction active in those intervals are recorded. Entries for devices restricted to input only or output only traffic show only one reporting line. Figure 205 on page 493 shows the format of the Transaction report.

This organizes the data like the Line-and-Terminal report, except that it is ordered by transaction code.

```
            L I N E   A N D   T E R M I N A L   R E P O R T          D A T E  04/17/93                        P A G E    1
LINE RTN        TOTAL        TOTAL         AVG                HOURLY        DISTRIBUTION
 OR NODE R/S   MESSAGES    CHARACTERS      SIZE  00-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-24

DSWP0011
PDSW0011 S           13         2,098       161     0     0     0     0     0     0     0     0     0    13     0     0     0     0
         R            7         1,067       152     0     0     0     0     0     0     0     0     0     7     0     0     0     0
DSWP0012
PDSW0012 S           11           352        32     0     0     0     0     0     0     0     0     0    11     0     0     0     0
         R            3           190        63     0     0     0     0     0     0     0     0     0     3     0     0     0     0
DSWP0013
PDSW0013 S           14         1,775       126     0     0     0     0     0     0     0     0     0    14     0     0     0     0
         R            7         1,012       144     0     0     0     0     0     0     0     0     0     7     0     0     0     0
DSWP0014
PDSW0014 S           15         1,151        76     0     0     0     0     0     0     0     0     0    15     0     0     0     0
         R            5           825       165     0     0     0     0     0     0     0     0     0     5     0     0     0     0
DSWP0015
PDSW0015 S           12           678        56     0     0     0     0     0     0     0     0     0    12     0     0     0     0
         R            5           491        98     0     0     0     0     0     0     0     0     0     5     0     0     0     0
DSWP0016
PDSW0016 S           11           355        32     0     0     0     0     0     0     0     0     0    11     0     0     0     0
         R            4           298        74     0     0     0     0     0     0     0     0     0     4     0     0     0     0
DSWP0017
PDSW0017 S           10           351        35     0     0     0     0     0     0     0     0     0    10     0     0     0     0
         R            3           190        63     0     0     0     0     0     0     0     0     0     3     0     0     0     0
DSWP0018
PDSW0018 S           14         1,736       124     0     0     0     0     0     0     0     0     0    14     0     0     0     0
PMTO1AP
CTRL     S           16           930        58     0     0     0     0     0     0     0     0     0    16     0     0     0     0
 SYSTEM  S       53,695     5,428,432       101     0     0     0     0     0     0     0     0     0 53695     0     0     0     0
 TOTALS  R       23,934     3,367,375       140     0     0     0     0     0     0     0     0     0 23934     0     0     0     0
```

key:

LINE RTN—Line Relative Terminal Number

R/S—Received/Sent

Figure 204. Line-and-Terminal Report

```
                  T R A N S A C T I O N   R E P O R T          D A T E  04/17/93                        P A G E    4
TRANSACTION     TOTAL        TOTAL         AVG                HOURLY        DISTRIBUTION
   CODE  R/S   MESSAGES    CHARACTERS      SIZE  00-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15 15-16 16-17 17-18 18-19 19-24

SC6T     S          947       208,340       220     0     0     0     0     0     0     0     0     0   947     0     0     0     0
         R          947        53,032        56     0     0     0     0     0     0     0     0     0   947     0     0     0     0
TS1Q     S          330        13,200        40     0     0     0     0     0     0     0     0     0   330     0     0     0     0
         R          330        18,150        55     0     0     0     0     0     0     0     0     0   330     0     0     0     0
TS1R     S          373        14,920        40     0     0     0     0     0     0     0     0     0   373     0     0     0     0
         R          373        20,515        55     0     0     0     0     0     0     0     0     0   373     0     0     0     0
TS1S     S          388        15,520        40     0     0     0     0     0     0     0     0     0   388     0     0     0     0
         R          388        21,340        55     0     0     0     0     0     0     0     0     0   388     0     0     0     0
TS1T     S          340        13,600        40     0     0     0     0     0     0     0     0     0   340     0     0     0     0
         R          340        18,700        55     0     0     0     0     0     0     0     0     0   340     0     0     0     0
 SYSTEM  S       53,695     5,428,432       101     0     0     0     0     0     0     0     0     0 53695     0     0     0     0
 TOTALS  R       23,934     3,367,375       140     0     0     0     0     0     0     0     0     0 23934     0     0     0     0
```

Figure 205. Transaction Report

Figure 206 on page 494 shows the format of the Transaction-Response report. This report gives the longest and shortest response times for each transaction code for the data selected as input from a set of system logs. Four columns record the percentile response times in seconds. The 25th, 50th, 75th, and 95th percentiles are given. For example, a response time within the 50th percentile is greater than or equal to 50% of the total number of response times processed for that transaction. The first line of response times given is from the completion of the receipt of the input message until the response message is successfully dequeued. In the event that an output message takes a significantly long time to be completely received at the terminal, a second line shows the receipt to the time the response message is started.

```
        T R A N S A C T I O N   R E S P O N S E   R E P O R T          D A T E  04/17/93                    P A G E    4
TRANSACTION      TOTAL          LONGEST          95%           75%           50%           25%          SHORTEST
   CODE        RESPONSES       RESPONSE       RESPONSE      RESPONSE      RESPONSE      RESPONSE      RESPONSE

                  947          03.0S          01.9S         00.2S         00.1S         00.1S         00.0S
  TS1Q              330            03.3S          00.6S         00.2S         00.1S         00.1S         00.0S
                  330          03.1S          00.5S         00.1S         00.0S         00.0S         00.0S
  TS1R              373            01.3S          00.5S         00.1S         00.1S         00.1S         00.0S
                  373          01.3S          00.4S         00.1S         00.0S         00.0S         00.0S
  TS1S              388            03.3S          00.7S         00.2S         00.1S         00.1S         00.0S
                  388          03.0S          00.5S         00.1S         00.0S         00.0S         00.0S
  TS1T              340            03.8S          00.6S         00.2S         00.1S         00.1S         00.0S
                  340          03.0S          00.5S         00.1S         00.0S         00.0S         00.0S
TOTAL RESPONSES =             26525
```

Figure 206. Transaction Response-Report

Assessing Program-to-Program Traffic

When a message processing program directs an output message to another program, that secondary transaction is queued. The transaction code is sometimes unique for convenience of the processing program's logic. Otherwise, the secondary transaction is queued along with any messages from terminal origin.

You can use the two Messages—Program-to-Program reports to separately count transaction traffic. Figure 207 illustrates the two tabulations. The column headed "Destination" appears above a list of transaction codes that were queued to another program. The originating program is not identified. The column headed "Transaction Code" appears above a list of the initial transaction codes that invoked the programs that issued the secondary transactions.

If you had program-to-program switches during conversational transaction processing, these will be included in the lists.

```
    MESSAGES--PROGRAM TO PROGRAM        DATE 10/06/88

                 TOTAL
DESTINATION      MESSAGES

ELEANOR              1
SW1050               1
T2741N1              1
T2742N3              1

    MESSAGES--PROGRAM TO PROGRAM        DATE 10/06/88

TRANSACTION      TOTAL
CODE             MESSAGES

TA10                 107
```

Figure 207. Messages—Program-to-Program Reports

Obtaining Counts of Unsent Messages

The two reports titled Messages—Queued-But-Not-Sent summarize how many output messages were still in the message queues for interval covered by the input tapes. The reports are illustrated in Figure 208 on page 495. Command responses that were not sent to the terminal are indicated by (IMSSYS). The entry of NOTAVA indicates "no transaction available". This would be the case if an output message

were generated for an input not recorded in the system log input data or by a command input from the same terminal not recorded.

```
  MESSAGES--QUEUED BUT NOT SENT       DATE 10/06/88

                    TOTAL
DESTINATION         MESSAGES

ELEANOR                1
SW1050                 1
T2741N                 1
T2742N3                1

  MESSAGES--QUEUED BUT NOT SENT       DATE 10/06/88

TRANSACTION         TOTAL
CODE                MESSAGES

(IMSSYS)               5
```

Figure 208. Messages—Queued-But-Not-Sent Reports

Auditing Critical Transactions

You can use the optional Messages report produced by the Statistical Analysis utility with the DFSIST40 program to examine the input and output data for specific transaction codes in detail. This allows you to audit exactly what was in an input message and possibly examine the output content for errors. The report is illustrated in Figure 209 on page 496.

Notice the entries flagged as THIS OUTPUT NOT RESULT OF INPUT. In the figure they show several responses to IMS commands sent to line 2 terminal 1, the master terminal. The entries are flagged because the outputs do not originate from a program invoked by an input transaction. If an automated operator program is active, you can use the output to trace its activity.

```
           MESSAGES

INPUT    TRANSACTION  LINE   RELA  SEQ  SYMBOLIC               OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX        CODE     NO    TERM  NO   ADDRESS   DATE    TIME  PREFIX  NAME      NO     ADDRESS    DATE    TIME
        THIS OUTPUT NOT RESULT OF INPUT                                 DSWP5008  00017  PDSW5008   93.107  15.54.1
                        3
OUTPUT  SEG=001 LEN=0001*F*
INPUT    TRANSACTION  LINE  RELA   SEQ  SYMBOLIC               OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX        CODE     NO   TERM   NO   ADDRESS   DATE    TIME  PREFIX  NAME      NO     ADDRESS    DATE    TIME
        THIS OUTPUT NOT RESULT OF INPUT                                 DSWP5008  00019  PDSW5008   93.107  15.54.4
OUTPUT SEG=001 LEN=0009*88-3-2000*
                                        3             3               3                        3
OUTPUT SEG=002 LEN=0248*WITHDRAWAL   $300.00 FDEPOSIT   $6704.62 FSAVINGS   444.44 FCHECKING    $9800.50 F*
                                        3             3               3                        3
                       *OVERDRAFT     $30.32FVISA       $2020.20 FMASTER CHRGE $105.00 FCARLOAN $1040.00 F*
                                      3
                       *TRANSFER C-5  $50.00 FCHRISTMAS CLUB  $94.60*
INPUT    TRANSACTION    NODE       SEQ  SYMBOLIC                  OUTPUT  NODE      SEQ    SYMBOLIC
PREFIX      CODE        NAME       NO   ADDRESS   DATE       TIME  PREFIX  NAME      NO     ADDRESS     DATE    TIME
          DE1Q          DSWPOO56  00015 PDSW0056  93.107   15.53.51        DSWP0056  00016  PDSW0056   93.107  15.54.2
                          03     0  18D
INPUT  SEG=001 LEN=0016*1BDE1Q  3Y43A*
INPUT  SEG=002 LEN=0230* 23(9) WITHDRAW OF $300DEPOSIT OF $6704.62SAVINGS DEPOSIT OF $444.44CHECKING TRANSFER OF $9800.50OV*
                       *ERDRAFT OF $30.32VISA ENTRY OF $2020.20MASTER CHARGE OF $105.00CAR LOAN OF $140.00TRANSFER C-S OF $*[1]
                       *50.00CHRISTMAS CLUB OF $94.60Y
INPUT    TRANSACTION    NODE       SEQ  SYMBOLIC
PREFIX      CODE        NAME       NO   ADDRESS   DATE       TIME
          DE1Q          DSWP0084  00017 PDSW5008  93.107   15.54.25
                                             3
OUTPUT SEG=001 LEN=0031*+ DATA SUCCESSFULLY RECEIVED +F*
INPUT    TRANSACTION  LINE   RELA  SEQ  SYMBOLIC                  OUTPUT   NODE      SEQ    SYMBOLIC
PREFIX      CODE       NO    TERM  NO   ADDRESS   DATE       TIME  PREFIX   NAME      NO     ADDRESS     DATE    TIME
          DE1Q[2]      DSWP016    00018 PDSW0116  93.107   15.54.36         DSWP0116  00016  PDSW0116   93.107  15.54.36
```

Notes:

1. Indicates a 230-character report message
2. Indicates a 31-character message generated by the transaction code ″DE1Q″ and transmitted to a relative terminal DSWP0116.

Figure 209. Messages Report

Log Transaction Analysis Utility Reports

You can obtain detailed data at the individual transaction level by using the Log Transaction Analysis utility. Although the data is not summarized by this utility, the detail report lines bring together many information items that help you assess the service given to a transaction type and the effect of the scheduling algorithm. The report shows actual response data because input data is the IMS log.

If you do not process the entire IMS log, data is presented from a starting checkpoint to a cutoff point. You limit the sample of transaction processing to be analyzed by specifying start time and duration in minutes, or you can give the number of checkpoints to be included after the starting checkpoint. Nonrecoverable or canceled messages are omitted.

The format of the Log-Analysis report is illustrated in Figure 210 on page 497. Times are given to the nearest tenth of a second and are elapsed times. The full list of data items for each report detail line is shown in Table 54 on page 497. You can see that the Processing Types field is a key description item.

Using the starting position and lengths of the fields in the report detail records you can specify a sort order for the second step in the utility execution.

Example: The sort control statement to cause a report to be sequenced by message class and transaction priority is:

```
SORT FIELDS = (18,3,CH,A,16,1,CH,A)
```

You can also use the option of creating a DASD data set of the detail report records. Your installation could then develop an analysis program to extract and summarize the data.

Examining Scheduling Activity

Using the data extracted by the Log Transaction Analysis utility (see Figure 210) you can examine the effect of your scheduling algorithm. Each occurrence of a transaction primarily indicates:

- Message priority and message class
- Time in input queue
- Time to process
- Time in output queue
- Total time-in-system (measured between completion of message queue input to retrieval for output)

You can look at the processing type 'S' entries to see the send and receive times. You can sort the detail report lines by transaction code and look at any critical transactions requiring rapid response time. Refer to Table 54 for details on each table line item.

```
09.01.17 JOB  163  $HASP373 DFSILTA0 STARTED - INIT  1 - CLASS G - SYS 3090
09.01.19 JOB  163  +DFS0412 - MISSING 08 RECORD
09.01.19 JOB  163  +DFS0412 - MISSING 08 RECORD
09.01.19 JOB  163  +DFS0412 - MISSING 08 RECORD
09.01.19 JOB  163  +DFS0412 - MISSING 08 RECORD
09.01.20 JOB  163  +DFS0410 - END OF FILE ON LOG DATA SET
09.01.20 JOB  163  SMF000I  DFSILTA0    DFSILTA0    DFSILTA0    0000
09.01.20 JOB  163  $HASP395 DFSILTA0 ENDED
------ JES2 JOB STATISTICS ------
 25 MAY 88 JOB EXECUTION DATE
        19 CARDS READ
       106 SYSOUT PRINT RECORDS
         0 SYSOUT PUNCH RECORDS
         6 SYSOUT SPOOL KBYTES
      0.05 MINUTES EXECUTION TIME

         JOB /DFSILTA0/ START 88146.0901
         JOB /DFSILTA0/ STOP  88146.0901 CPU    0MIN 00.13SEC SRB    0MIN 00.02SEC
                                                                                                                                  PAGE 00001
 SEQ    TRANS  P   C  ***IN***   ***OUT**  P   PGM     DR SMB*ENQ  MSG*SCHD CNT*ENQ  MSG*END  CNT*GU  SYS IN Q   PROC   OUT Q  TOTAL
 NBR    CODE   R   L  RLINE/RT   RLINE/RT  T   NAME    ID HHMMSST  HHMMSST  HHMMSST  HHMMSST  HHMMSST  ID SSSST  SSSST  SSSST  SSSST
-------------------------------------------------------------------------------------------------------------------------------------
00001  CHKPT   0001************************              853515   853515   853515   853515   853515
00002 TXCDRN24 0     000002 001            B *RESTART   1  930231   930231
00003 TXCDRN24 0     000002 001            B *RESTART   1  930140   930140
00004 TXCDRN24 0     000002 001            B *RESTART   1  930069   930069
00005 CONV1    0     00001A 001            B *RESTART   1 1451305  1451305
00006 CONV1    0     00001A 001 00001A 001 B *RESTART   1 1451107  1451144
00007  CHKPT   0002************************              856091   856091   856091   856091   856091
```

Figure 210. Log-Analysis Report

Table 54. Log-Analysis Report Line Format

Identification	Starting Position	Length	Note
Sequence Number	1	5	1
Transaction Code	7	8	
Priority of Transaction (PR)	16	1	
Class of Transaction (CL)	18	3	

Table 54. Log-Analysis Report Line Format (continued)

Identification	Starting Position	Length	Note
Input Node Name (for VTAM)	22	8	
Input Relative Line (or VTAM node name)	22	6 (8)	9
Input Relative Terminal (for non-VTAM)	29	3	
Output Node Name (for VTAM)	33	8	
Output Relative Line (or VTAM node name)	33	6 (8)	9
Output Relative Terminal (for non-VTAM)	40	3	
Processing Type (PT)	44	1	2
Program Name	46	8	
Dependent Region ID	55	3	
Time of SMB Enqueue (Transaction received)	59	7	3
Time of Message Schedule or GU	68	7	3
Time of CNT Enqueue (Message put on output queue)	77	7	3
Time of Program End or Next Message GU	86	7	3
Time of CNT GU (Output message starts to terminal)	95	7	3
System IDs	103	3	
Time in Input Queue	106	6	4, 5
Time Processing	113	6	6, 5
Time in Output Queue	120	6	7, 5
Total Time	127	6	8, 5

Notes to Table 54 on page 497:

1. Starting position 1 is a carriage control character which alters the starting positions of the fields when producing a report on disk.
2. Processing types:

   A Program Abend or Unconnected Transaction

   B Processing restarted

   C Conversational Send/Receive Processing

   D Transmit Only Conversational Processing

   F /FORMAT entered (Transaction Code Field has MODNAME)

   M Message Switch

   O Region Occupancy (A region is occupied by a program that is processing transactions that existed in the input queue before the start checkpoint has encountered or a program scheduled by an unrecoverable message.)

   P Program Switch Send/Receive Processing

   Q Transmit Only Program Switch Processing

   R Program was running at time of IMS abend

   S Send/Receive Processing

T Transmit Only Processing

X Conversational Program Switch, Send/Receive Processing

Y Transmit Only Conversational Program Switch Processing

3. Time HHMMSST
4. Input queue time is from SMB enqueue to message schedule.
5. Time SSSST or OVRFLW (If the total seconds exceeds the field size, OVRFLW is printed).
6. If the wait-for-input (WFI) system option is used, the time processing field also includes the wait time between transactions.
7. Output queue time is from CNT enqueue to CNT GU.
8. Total Time is from SMB enqueue to CNT dequeue. The total time spans the complete transaction.
9. For VTAM terminals, the input relative line and input relative terminal fields are replaced with an input VTAM terminal node name. The output relative line and output relative terminal fields are replaced with an output VTAM terminal node name. The node name fields are 8 characters long.

IMS Accounting Information

The nature of accounting methods varies a great deal among data processing installations. The IMS Transaction Manager presents special difficulties, because many and varied transactions are processed by a partnership of the control region and dependent regions. Further, operationally discrete applications can be served concurrently.

For installations with IMS-dedicated processors, the overall cost of hardware and support functions is often charged back based on predicted and actual use by contributing groups. For shared systems, the processor usage can be the base for proportional cost.

Although IMS does not have an explicit accounting function, the individual events that make up the processing activity are recorded on the IMS log in considerable detail. Analysis of IMS log records can be used as a basis for charge-back algorithms. You can, for example, obtain a report from the Statistical Analysis utility of the number of transactions and the average number of DL/I calls for each transaction.

Another source of resource usage figures is the reports produced as a result of IMS Monitor data collection. Samples of processing activity can be taken on a regular basis. Accounting algorithms can use, for example, processor utilization by program.

Both of these approaches require further manipulation and calibration of the resource indicators.

If the DL/I address space option is used (LSO=S), accounting procedures based on SMF data will be affected. SMF statistics for IMS system data sets and Fast Path databases are accounted to the control region procedure. Full function databases are accounted to the DL/I address space procedure.

Using the Application-Accounting Report

The Statistical Analysis utility produces an Application-Accounting report that you can use to assess machine charges. The following breakdown is provided for each transaction and for each program:

- The number of messages with related total and average processor time in seconds
- The number and type of DL/I message calls
- The number and type of DL/I database calls

Figure 211 illustrates the output format.

```
       A P P L I C A T I O N   A C C O U N T I N G   R E P O R T        D A T E  04/17/93                      P A G E     4
PROGRAM TRANSACTION   MESSAGE- - - - COUNTS    DATA - - - - - - - - - - BASE - - - - - - - - - COUNTS  CC OR RC     TOT PROG      AVR
 NAME      CODE   PRI QTY    GU    GN  ISRT*   GU    GN   GNP   GHU   GHN  GHNP  ISRT  DLET  REPL   NOT 0       CPU TIME      TIME

PROGTS1R TS1R     01  373   717     0   373     0     0     0     0     0     0     0     0     0     0            01.1S      0.003S
PROGTS1S TS1S     01  388   748     0   388     0     0     0     0     0     0     0     0     0     0            01.1S      0.003S
PROGTS1T TS1T     01  340   657     0   340     0     0     0     0     0     0     0     0     0     0            01.0S      0.003S
SYSTEM TOTALS         349*  580*  107*  704* 1025*  328* 1520*  247*    0   249*  348* 3664   460*    0        06M 55.5S      0.011S
* INDICATES TOTAL SHOWN IN 100'S
@ INDICATES TOTAL SHOWN IN 10,000'S
              I M S   ACCOUNTING   REPORT                              D A T E  04/17/93                       P A G E     1


         START TIME 15:50:50
         I M S  DAY             04/17/93**
          STOP TIME 15:56:16
REPORT PERIOD IS FROM 04/17/93 TO 04/17/93.
END OF REPORTS
```

***** Second insert is counted for single user issued insert if all the following conditions are met:

1. New HIDAM or PHIDAM Root
2. Not Duplicate Key (II status not returned)

****** These dates will not appear unless the input to DFSIST30 is sorted with date control.

Figure 211. Application-Accounting Report

The disadvantage is that the output is only for the interval covered by the IMS log input. You must coordinate the input data sets and accumulate the statistics. A large number of data sets would not be insignificant to process, because the utility uses two edit and sort passes, producing intermediate tape output.

Recommendation: If you use the utility, specify the NOTXT option on the step 1 EXEC statement, because this saves considerable sort data manipulation.

Using IMS Transaction Profiles

You can use a composite picture of each transaction as a basis for estimating usage. The IMS Transaction profile can contain DL/I call requirements by type of call and possibly items derived from path length for other processing blocks. You can weight the message count to allow for heavy DL/I use by the transaction. Transaction statistics can be obtained on a regular basis from `/DISPLAY` output, for example at end-of-day or before shutdown.

The profiles should characterize the IMS workload in such a way that growth trends and major deviations from the predicted load can be traced to the transaction codes responsible.

Part 6. Knowledge-Based Log Analysis

Chapter 23. Knowledge-Based Log Analysis Overview

Knowledge-Based Log Analysis (KBLA) is a collection of IMS utilities that provides an ISPF user interface to perform log record selection and analysis by invoking internal routines and other IMS utility programs. KBLA uses an ISPF panel-driven user interface to simplify JCL job creation and to prevent JCL errors. KBLA generates the JCL and control statements necessary to run the supported utilities. This JCL preparation allows you to focus on the output of the utility used rather than on how to code JCL to extract information.

The following topics provide additional information:

- "Invoking KBLA from the IMS Application Menu"
- "Maintaining the KBLA Environment with Option 0" on page 507
- "Defining the Selection of IMS Logs using Option 5" on page 507
- "Using KBLA to Run a Job Against IMS Log Records" on page 508

Invoking KBLA from the IMS Application Menu

KBLA can be invoked from the IMS Application Menu. To access KBLA, first access the IMS Applications Menu by typing this command: `EXEC 'hlq.SDFSEXEC(DFSAPPL)' 'HLQ(hlq)'`.

Note: hlq is the high-level-qualifier associated with the installed IMS subsystem.

Figure 212 shows the IMS Applications Menu panel.

Related Reading: For more information about using the IMS Application Menu, see the *IMS Version 9: Installation Volume 1: Installation Verification*.

```
                    IMS Application Menu

Select the desired application and press Enter.


         1   Single Point of Control (SPOC)
         2   Knowledge-Based Log Analysis (KBLA)
         3   HALDB Partition Definition Utility (PDU)
         4   Syntax Checker for IMS parameters (SC)
         5   Installation Verification Program (IVP)
         6   IVP Export Utility (IVPEX)


 To exit the application, press F3.









Command ===>
```

Figure 212. IMS Applications Menu

From the IMS Applications Menu, select option 2 for KBLA. Figure 213 on page 506 shows the main panel of KBLA.

Invoking KBLA from the IMS Application Menu

```
           Knowledge Based Log Analysis   IMS Version 9.1
Command ===>

                                                    TIME....17:15:07
                                                    DATE....2003/10/01
                                                    JULIAN..2003.274
Select any of the following tasks and press ENTER .  USERID..TSOUSER


      Tasks . .    0. KBLA Environment Maintenance
                   1. IMS Log Utilities
                   2. IMS Log Formatting
                   3. IMS Log Data Set Summary
                   4. IMS Knowledge Based Analysis
                   5. Log Selection



To Exit the KBLA MAIN menu, press END .
For Help place cursor on any field and press PF1 .
```

Figure 213. Main Panel for KBLA

KBLA provides you with a set of ISPF panels which you can use to access log analysis-related utilities and functions. A set of help panels for each function or sub-function can also be displayed. Field level help is supported by placing the cursor on the subject field and pressing the HELP Key (PF1). Figure 214 shows the structure of the KBLA ISPF panels.

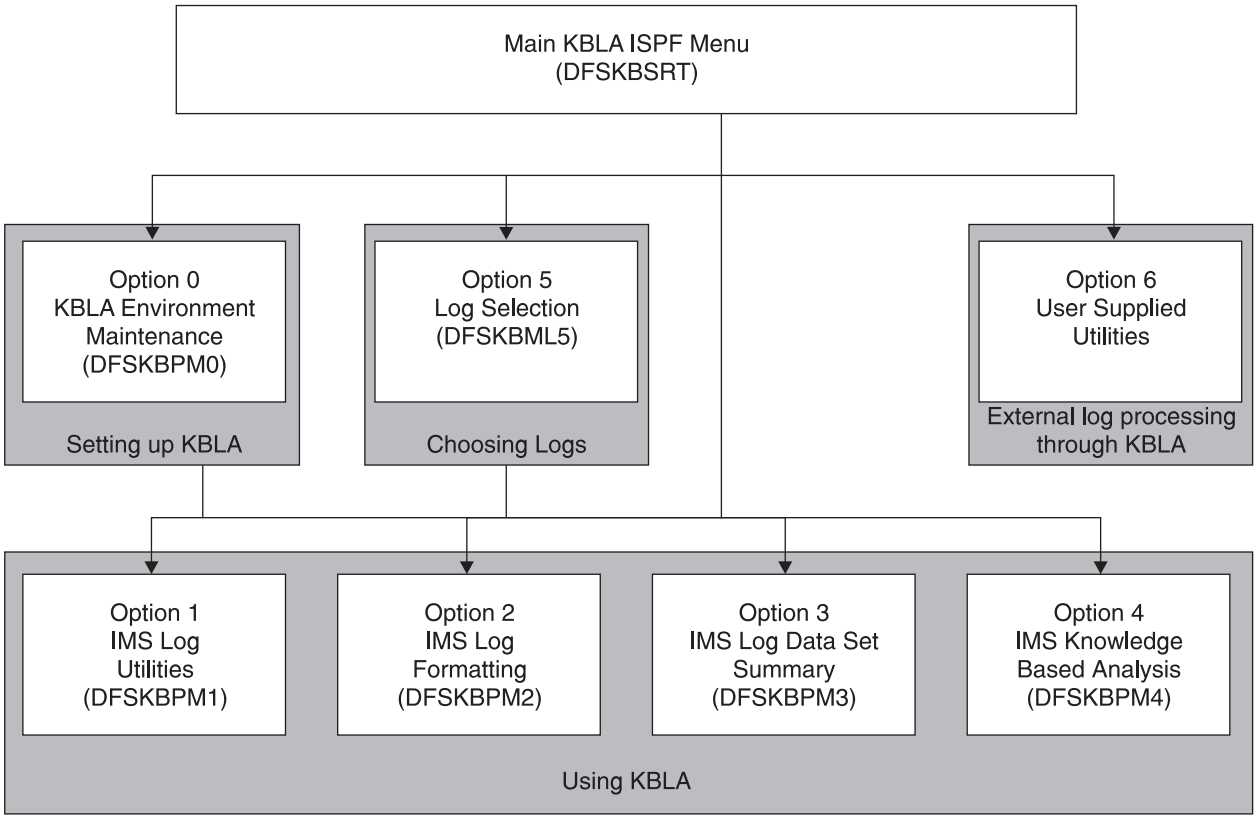


Figure 214. KBLA Panel Structure

Maintaining the KBLA Environment with Option 0

Use option 0 to perform global maintenance on your KBLA environment. Parameters entered in KBLA panels are stored as ISPF variables and are used by other panels, as appropriate. It can be useful to complete the KBLA Maintenance Environment panel first in order to tailor KBLA to specific needs. If entries are not specified, KBLA fills some fields with default values. The default JCL job statement is extracted from `hlq.SDFSSLIB(DFSKJOBK)`. Other default values include:

Table 55. KBLA Fields and Default Values

Field	Default Value
KBLA Loadlib	hlq.SDFSRESL
IMS Version	9
Reslib DSN	hlq.SDFSRESL
Verify LOG DSN Exists	Y
Default Output Space Parms: Type	CYL
Primary	100
Secondary	50
Route output to alternate system	N

Suboptions available for KBLA environment maintenance include:

1. Tailoring the KBLA panels according to your ISPF environment, DSN naming convention, JOB JCL requirements, IMS.SDFSRESL used, and RECON-related information
2. Creating a list of the work data sets that have been created as you use KBLA
3. Viewing the list of the work data sets
4. Deleting work data sets that are no longer needed

Defining the Selection of IMS Logs using Option 5

Use option 5 to create a list of logs to be processed by KBLA. KBLA can process logs from different sources. Sometimes multiple IMS log data sets must be used. The RECON data sets can be accessed to extract the names of PRIOLD, PRISLD, PRILOG, SECOLD, SECSLD, or SECLOG data sets. A copied or manually entered list of logs can also be used as input to KBLA. In addition to accepting a list of IMS logs, KBLA can separate the list by IMS SYSID into multiple lists, each sorted by time stamps.

The following suboptions create and sort the final list of logs for input to KBLA:

1. Extract log data sets from the RECON data sets or as the result of a LIST.LOG RECON command.
2. Create a member or members in your SDFSKJCL PDS that contains a manually entered list of log data sets to be processed by KBLA options.
3. Use the list of logs created in suboption 2 to create new sorted members in the SDFSKJCL PDS, which can be used as input by other KBLA processing options. This suboption separates the log data set names by IMS SYSID and sorts the log data set names by time stamp or line sequence number.
4. Sort records within logs using up to four criteria. This suboption is used to process unformatted log records that have been previously selected by KBLA (use Option 2 with Log Formatting Type 'U'). The sorted log records can then be

used as input for the formatting and analysis steps of KBLA. This suboption sorts individual log records within a log data set and then sends the sorted log to KBLA for processing.

Using KBLA to Run a Job Against IMS Log Records

Use the remaining four options from the main panel of the Knowledge-Based Log Analysis utility to format and analyze a log record. A brief description of each option follows.

Option 1: IMS Log Utilities

This option allows you to access the following log analysis utilities:

1. Chapter 16, “Log Transaction Analysis Utility (DFSILTA0),” on page 353
2. Chapter 14, “Fast Path Log Analysis Utility (DBFULTA0),” on page 325
3. Chapter 17, “Statistical Analysis Utility (DFSISTS0),” on page 359
4. Chapter 10, “Log Merge Utility (DFSLTMG0),” on page 263
5. Chapter 11, “Log Recovery Utility (DFSULTR0),” on page 267
6. “Program Isolation Trace Record Format and Print Module (DFSERA40)” on page 316
7. Chapter 26, “IMS Records User Data Scrub Utility (DFSKSCR0),” on page 531

Option 2: IMS Log Formatting

This option allows you to extract or format log records. Suboptions include:

1. IMS Resources Formatting
2. IMS Subcomponent Log Filtering
3. KBLA Log Records Formatting
4. IMS Trace Formatting
5. Snap/Pseudo-Abend Record Formatting
   a. Chapter 32, “Deadlock Trace Record Analysis Utility (DFSKTDL0),” on page 575 for K-formatted database deadlock traces
   b. DFSERA10 using the “Record Format and Print Module (DFSERA30)” on page 309 for all other traces

Related Reading: See Chapter 24, “KBLA Log Formatting Modules,” on page 511 for more information on suboptions 1–4.

Option 3: IMS Log Data Set Summary

This option produces a summary of the log data set that you specified along with some statistical information. The summary function includes:

- First and last line sequence number (LSN) in the log
- Time stamp (UTC) of the first and last log record
- Total number of log records in the log data set
- Presence of internal trace records, system restarts, dump log records, system checkpoint
- Number of log records present for each record ID
- System configuration
- Transaction, program and data bases records instances

Option 4: IMS Knowledge-Based Analysis

This option provides different methods for knowledge-based formatting, analysis and interpretation of specific IMS log records. You can access different utilities with the following suboptions, each one with its own ISPF panel interface.

1. Chapter 31, “Log Summary Utility (DFSKSUM0),” on page 559

   You can use this utility to specify search criteria to extract the supported log records. Log record types that can be processed during the analysis include: X'01', X'03', X'07', X'08', X'11', X'12', X'13', X'16', X'20', X'21', X'27', X'29', X'31', X'33', X'35', X'36', X'36', X'37', X'38', X'3F', X'40', X'41', X'42', X'42', X'45', X'47', X'4C', X'50', X'51', X'52', X'56', X'57', X'59', X'63', and X'72'.

   Search criteria can include the following:

   - UOW (unit of work)
   - LTERM name
   - NODE name
   - TRANSACTION name
   - Program name (PGM)
   - DBD name
   - AREA name
   - User ID
   - RBA
   - Recovery Token
   - Message DRRN
   - A generic character or hexadecimal search string

   The “Dynamic Search Keys” parameter allows you to create an increasingly refined and broader search argument to include additional records that are related to the specified search criteria.

   The Log Summary utility can also be used to create a summary of the log records and to view the configuration of an IMS subsystem based on the contents of the log records.

2. Chapter 27, “MSC Link Performance Formatting Utility (DFSKMSC0),” on page 535

   This utility uses IMS MSC log records to measure the overall performance of each link defined in the system. Two different reports are produced; one is a summary and the other is more detailed.

3. Chapter 28, “Statistic Log Record Analysis Utility (DFSKDVS0),” on page 539

   This utility enhances formatting of the IMS-produced log record X'45'.

4. Chapter 33, “Trace Record Extract Utility (DFSKXTR0),” on page 585

   This utility extracts specific trace table entries that match specified selection criteria from trace table log records for subsequent formatting by DFSERA10 and DFSERA10-related exit routines. DFSKXTR0 reduces the amount of data unrelated to the selection criteria in the formatted reports.

5. Chapter 29, “IRLM Lock Trace Analysis Utilities (DFSKLTA0, DFSKLTB0, DFSKLTC0),” on page 543

   These utilities create and combine several outputs, including one based on wait time order. In the wait-time-ordered report, databases are ordered by the total lock wait time during the trace. DFSKLTC0 has an option for placing the request completion order report to a data set, which can then be sorted either by this ISPF panel’s options or using a SORT program to produce a report in any order.

6. Chapter 25, “DBCTL Transaction Analysis Utility (DFSKDBC0),” on page 525

This utility combines the functions of the DBFULTA0 and DFSILTA0 utilities and can produce a sorted output using key fields that can help to identify potential performance problems.

7. Chapter 34, “Log Record Processing Rate Analysis Utility (DFSKRSR0),” on page 595

   This utility generates reports that summarize the volume of log data, by record type and subtype, that is being generated by an IMS subsystem. The volume of log data is expressed in number of records per second and number of bytes per second.

External Log Processing using Option 6

Use option 6 to access any external log processing utility or IMS tool available in your environment. You can launch up to 4 different utilities or tools from this panel by specifying the corresponding EXEC statement in the `TSO Exec` field.

Chapter 24. KBLA Log Formatting Modules

The KBLA Log Formatting Modules (DFSKBLA3, DFSKBLA7, DFSKBLA8, DFSKBLA9, DFSKBLAK, and DFSKBLAS) are exit routines based on the File Select and Formatting Print Utility (DFSERA10). For more information on DFSERA10, see Chapter 13, "File Select and Formatting Print Utility (DFSERA10)," on page 295.

The following topics provide additional information:

- "KBLA Basic Record Formatting and Print Module (DFSKBLA3)"
- "KBLA Basic Record Formatting Module (DFSKBLA7)" on page 513
- "KBLA Summary Record Formatting Module (DFSKBLA8)" on page 516
- "KBLA Knowledge-Based Record Formatting Module (DFSKBLA9)" on page 518
- "KBLA Summary Record Formatting and Print Module (DFSKBLAS)" on page 520
- "KBLA Knowledge-Based Record Formatting and Print Module (DFSKBLAK)" on page 521

KBLA Basic Record Formatting and Print Module (DFSKBLA3)

Use the KBLA Basic Record Formatting and Print Module (DFSKBLA3) to format trace and general purpose log record types. DFSKBLA3 is an exit routine of the File Select and Formatting Print Utility (DFSERA10). Because this routine formats log records, it passes a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing.

For IMS log records, NODE trace entries, and SNAP subrecord types, DFSKBLA3 creates log record header information describing what the log record identifier represents and the time stamp at which the record was written.

When using the KBLA panel-driven interface to format log records, specify 'B' (for Basic) as the Log Formatting Type on KBLA panels 2.1, 2.2, 2.3, or 4.1 to generate the control statements necessary to run this routine. Figure 215 on page 512 is an example of the Log Record Formatting panel in the KBLA panel-driven interface.

```
. . . . . .
             == K.B.L.A.  Log Record Formatting ==
COMMAND ===>


Input IMS Log DSN IMS.SAMPLE.LOG                          Cataloged? Y

IMS Log Version. . . . . 9
Extract Record(s). . . . .                                    (eg. 01 02 5912)

Log Formatting Type. . . . B             (B,S,K or U)
Output DSN Keyword . . . . TEST
                                         Output DSN: USERID.Keyword.KBLA
Optional parameters
  Print /TRA Log Record. . N             (Y/N)
  Print Internal Traces. . N             (Y/N)
  Filter by Keyword. . . . X'08000C3D'
  No. Records to Scan. . .
  No. Records to Skip. . .

  Log DSNs were extracted from RECON.
  PDS member containing logs . . . ..
```

Figure 215. KBLA Log Record Formatting Panel to Invoke DFSKBLA3

Utility Control Statements for DFSKBLA3

Figure 216 shows an example of the control statements required to format type X'67aa', X'03', and X'16' log records using the DFSKBLA3 module.

```
Column 1     Column 10     Column 16                          72

CONTROL      CNTL
OPTION       PRINT         OFFSET=5,FLDLEN=2,                  X
                           VALUE=67aa,COND=E,                  X
                           EXITR=DFSKBLA3
OPTION       PRINT         OFFSET=5,FLDLEN=1,                  X
                           VALUE=03,COND=E,                    X
                           EXITR=DFSKBLA3
OPTION       PRINT         OFFSET=5,FLDLEN=1,                  X
                           VALUE=16,COND=E,                    X
                           EXITR=DFSKBLA3
END
```

Figure 216. Control Statements Required for DFSKBLA3

In Figure 216, `aa` is the log record subtype.

aa=01 Specifies TRACE log record subtype. NODE trace entry identifiers are interpreted.

aa=FD Specifies SNAP log record subtype.

aa=FF Specifies ABEND log record subtype.

Output for DFSKBLA3

Figure 217 on page 513 shows a sample formatted log from DFSKBLA3.

```
03 RECORD    OUTPUT MESSAGE QUEUED          DATE/TIME: 2003-07-10 20:27:17.350994 UTC
MSG PREFIX HEADER
 00000000 000000   04EC0000 03C18110  08000006 08000006   04DC8002 E3C9F1E3  40404040 B9B30901   *.....AA.............TI1T    ....*
 00000020 000020   C1D84482 E3C9F1E3  40404040 B9B30906   C90B2F22 40000100  00000000 00000000   *AQ.BTI1T    ....I... ..........*

SYSTEM PREFIX
 00000000 000000   00408100 C8100000  00000000 00000000   514D0007 00010000  00000000 00000001   *. A.H.............(.............*
 00000020 000020   FEFFFFFF 2931D460  E3C3F6F7 F0F9F1F0   00000000 00000000  40404040 40404040   *......M-TC670910........        *

EXTENDED PREFIX HEADER
 00000000 000000   00108600 045CFD00  00000000 00000000                                       *..F..*.........                *

APPC/OTMA/LU62 PREFIX
 00000000 000000   028E8700 0040C389  05C62000 C3E2D8F0   F0F0F9F4 E3C3F6F7  D5C9C1D3 B96B792B   *..G.. CI.F..CSQ00094TC67NIAL.,..*
 00000020 000020   8B253384 00000000  00000000 E3D4F1E3   40404040 40404040  40404040 E3C9F1E3   *...D........TM1T            TI1T*
 00000040 000040   40404040 B96B792B  8B253384 08100078   00000000 00000000  00000000 00000000   *    .,.....D.....................*
 00000060 000060   00000000 00000000  2A0C8180 00000000   00000000 00000000  01400000 0040C3E2   *.........A.............. ... CS*
 00000080 000080   D8F0F0F0 F9F4A0F0  00006D8D 00000000   0000AE78 00010000  00480040 01004040   *Q00094.0.._.............. ..  *
 000000A0 0000A0   40404040 40402020  20202020 20202020   20202020 20207F19  6D580000 0000B9B3   *      ................"._.......*
 000000C0 0000C0   0901C176 11030000  00000000 00000000   00000000 00004040  40404040 40400000   *..A.................        ..*
 000000E0 0000E0   0060C652 51005001  80535554 55555555   55555555 55555555  55555555 55555555   *.-F...&.....................*
 00000100 000100   55555555 55555555  55555555 55555555   55555555 5555B7B6  969C808C 918C5555   *.....................O...J...*
 00000120 000120   55555555 5555B796  B7B690B7 B6A45555   55555555 55550902  E2C3E2E3 C5E2E3F1   *.......O.....U..........SCSTEST1*
 00000140 000140   014ED4C4 40400000  00010000 00000000   0001FFFF FFFF0000  00000000 03110000   *.+MD  .........................*
 00000160 000160   01F4D4D8 C9D4E240  40400000 00000000   0001C3E2 D840E3D4  F1E34040 40404040   *.4MQIMS   ........CSQ TM1T      *
 00000180 000180   4040B9B3 090115A2  45A20000 00000000   00000000 00000000  00000000 00000000   *  .....S.S.....................*
 000001A0 0001A0   00000000 0000C3C9  C64BD8C1 D3C9C1E2   4BD9C5E2 D74BD3D6  C3C1D340 40404040   *......CIF.QALIAS.RESP.LOCAL     *
 000001C0 0001C0   40404040 40404040  40404040 40404040   40404040 4040E3D4  F1E34040 40404040   *                        TM1T      *
 000001E0 0001E0   40404040 40404040  40404040 40404040   40404040 40404040  40404040 40404040   *                                  *
 00000200 000200   40404040 4040E2C3  E2E3C5E2 E3F14040   40400000 00000000  00000000 00000000   *      SCSTEST1    ..............*
 00000220 000220   00000000 00000000  00000000 00000000   00004040 40404040  40404040 40404040   *..................              *
 00000240 000240   40404040 40404040  40404040 40404040   40400000 0002E3D4  F1E3C3C8 C9D54040   *                    ....TM1TCHIN  *
 00000260 000260   40404040 40404040  40404040 40404040   4040F2F0 F0F3F0F7  F1F0F2F0 F2F7F0F1   *                   20030710202701*
 00000280 000280   F6F04040 4040D4D8  C9D4E2E5 E240                                           *60    MQIMSVS                   *

SECURITY PREFIX
 00000000 000000   00168800 E2C3E2E3  C5E2E3F1 00000000   00000000 E400                       *..H.SCSTEST1........U.          *

WORK LOAD MANAGER PREFIX
 00000000 000000   00188900 00468000  B9B30901 C1E14C01   00000000 00000000                   *..I.........A.<.........        *

SYSTEM EXTENSION PREFIX
 00000000 000000   00188A00 2003191F  20270231 4516016D   00000000 00000000                   *..............._........        *

MSC EXTENSION PREFIX
 00000000 000000   00688B00 00000000  00000000 00000000   00000080 00000000  FEFFFFFF 2931D460   *.............................M-*
 00000020 000020   00000000 00000000  00000000 00030003   00000000 00000000  00000000 00000003   *................................*
 00000040 000040   00030003 E3C9F1E3  40404040 B9B30901   C1D84482 00000000  00000000 00000000   *....TI1T    ....AQ.B............*
 00000060 000060   00000000 00000000                                                          *........                        *

TRANSACTION MANAGER PREFIX
 00000000 000000   00908C00 00000303  00000000 00000065   E3C3F6F7 F0F9F1F0  FEFFFFFF 2931D460   *................TC670910......M-*
 00000020 000020   03030244 20080000  00000000 00000000   00000000 00000000  00000000 00000000   *................................*
 00000040 000040   00000000 08100000  00000000 00000000   00000000 00000319  9699C5ED E6542929   *.......................ORE.W...*
 00000060 000060   DCF80000 00001000  00000000 00000000   00000810 00000000  00000000 00000000   *.8.............................*
 00000080 000080   00000000 00000000  00000000 00000000                                       *................                *

USER PREFIX
 00000000 000000   00808E00 D6200319  1F202702 31410501   6D000000 00000000  00000000 0000C920   *....O..........._.............I.*
 00000020 000020   03191F20 27075866  60016D00 00000000   00000000 00000000  00000000 00000000   *........-._....................*
 00000040 000040   00000000 00000000  00000000 00000000   00000000 00000000  00000000 00000000   *................................*
 00000060 000060                     SAME AS ABOVE

RECORD SUFFIX
 00000000 000000   B9B30910 18E52321  00000000 00DFB20C                                       *.....V..........                *

16 RECORD    VTAM TERMINAL /SIGN OFF FORCED DATE/TIME: 2003-07-10 20:32:33.680372 UTC
 00000000 000000   00500000 16264000  000040A0 E9E9D2D7   F2404040 E9E9D2D7  F2404040 D4F0F3F0   *.&.... ... .ZZZZ2   ZZZZ2   A000*
 00000020 000020   F1F0F1F6 2003191F  20323367 9955016D   40404040 40404040  D4F0F3F0 F1F0F1F6   *0006........R.._        A0000006*
 00000040 000040   B9B30A3D C5BF4D20  00000000 00DFCC47                                       *....E.(.........                *

16 RECORD    VTAM TERMINAL /SIGN OFF FORCED DATE/TIME: 2003-07-10 20:32:35.660418 UTC
 00000000 000000   00500000 16264000  000040A0 E9E9D2D7   F2404040 E9E9D2D7  F2404040 D4F0F3F0   *.&.... ... .ZZZZ2   ZZZZ2   A000*
 00000020 000020   F1F0F9F0 2003191F  20323566 0018016D   40404040 40404040  D4F0F3F0 F1F0F9F0   *0090..........._        A0000090*
 00000040 000040   B9B30A3F A9282D64  00000000 00DFCC64                                       *....Z...........                *
                                                                                                                                  *
```

Figure 217. Sample Formatted Log from DFSKBLA3

KBLA Basic Record Formatting Module (DFSKBLA7)

Use the KBLA Basic Record Formatting module (DFSKBLA7) to:

- Produce expanded log records from compressed IMS logs.

- Select and format X'5' (full function 50X and fast path 5950) log records based on data contained within the record itself, such as the contents of a time, date, or identification field. These records are formatted with all log record types listed under the PARM TOKEN= description.
- Change the format of log output to identify and emphasize select log fields.

Specify the search criteria for the routine as subparameters of the PARM= parameter of the OPTION statement for the File Select and Formatting Print utility (DFSERA10). Each subparameter must be uppercase and cannot contain any blanks. The subparameter data must be character or decimal. Hexadecimal data must be preceded by an X and the data enclosed in single quotes (for example, X'0123').

When the record is selected, it can be written to tape or DASD.

When multiple subparameters are specified, all conditions must be met to select a record. Use multiple routines to select records if some of the conditions have been met.

DFSKBLA7 calls DFSKBLA3 to format the output.

Unrecognized characters or invalid parameter specifications are ignored by this routine.

The possible subparameters of PARM= are:

XFMT=
Extends the X'50' log record format to enhance the retrievability of certain data entries.

Y Highlights the log data for certain types of processing by placing the data on a separate line and adding identifiers for data entries. It applies to log data that describes the following types of processing: data sharing, XRF buffer and lock tracking, space management, key, backout (undo), and recovery (redo). If a type of processing is not relevant, the data section is omitted.

These data sections are added after the unformatted log data for the record. Each section includes identifiers followed by hexadecimal log data, character log data, or both. They contain the following entries, where X represents hexadecimal log data and C represents character log data:

Data sharing

```
DSHRDSSN XXXXXXXX DSHRLSN XXXXXXXXXXXX DSHRUSID
XXXXXXXX RACF-UID CCCCCCCC XXXXXXXXXXXXXXXX
```

XRF buffer and lock tracking

```
TRAKPLSZ XXXX TRAKBUFN XXXX TRAKHASH XXXXXXXX
TRAKLOCK XXXXXXXX TRAKFLGS XX XX
```

Space management

```
SMGTFLGS XX XX SMGTROFF XXXX SMGTRLEN XXXX
```

Key

```
KSDS  Character string describing database action
LENGTH XXXX
One or more lines of mixed hexadecimal and character data
```

Undo

```
UNDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

Redo

```
REDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

N Does not highlight the log data for data sharing, buffer and lock tracking, space management, key, backout or recovery. The data is formatted as part of the raw data for the record.

XFMT=N is the default value.

PST=*pst_number*
Selects records containing the PST number.

SYSID=system_id
Selects records for the system ID portion of the recovery token.

TOKEN=token
Selects records for the hexadecimal token portion of the recovery token. You can select the following record types: X'07', X'08', X'0A', X'13', X'27', X'28', X'31', X'32', X'35', X'37', X'38', X'39', X'3D', X'41', X'4C', X'50', X'56', X'59', X'5901', X'5903', X'5937', and X'5938'.

PSB=*psb_name*
Selects records for the PSB name.

DBD=*dbd_name*
Selects records for the DBD name.

RBA=*rba_value*
Selects records for the RBA logical record length (LRECL).

BLOCK=*block_rba*
Selects records for the RBA block.

USERID=*userid*
Selects records for the user id.

KEY=*ksds_key*
Selects records for the key.

OFFSET=*offset*
Selects records that update a given offset of data in the buffer.

UNDO=*undo_data*
Selects records for backout data that matches the character string you specify. The maximum length of the character string is 255 characters.

REDO=*redo_data*
Selects records with recovery data that matches the character string you specify. The maximum length of the character string is 255 characters.

DATA=*log_data*
Selects records with data, including compressed data, that matches the character string you specify (searches all log records). The maximum length of the character string is 255 characters.

KBLA Summary Record Formatting Module (DFSKBLA8)

Use the KBLA Summary Record Formatting module (DFSKBLA8) to:

- Produce expanded log records from compressed IMS logs.
- Select and format X'5' (DL/I 5X and fast path 5950) log records based on data contained within the record itself, such as the contents of a time, date, or identification field. These records are formatted along with all log record types listed under the PARM TOKEN= description.
- Change the format of log output to identify and emphasize some optional log fields

Specify the search criteria for the routine as subparameters of the PARM= parameter of the OPTION statement for the File Select and Formatting Print utility (DFSERA10). Each subparameter must be uppercase and cannot contain any blanks. The subparameter data type must be character or decimal. Hexadecimal data must be preceded by an X and the data enclosed in single quotes (for example, X'0123').

When the record is selected, it can be written to tape or DASD.

When multiple subparameters are specified, all conditions must be met to select a record. Use multiple routines to select records if some of the conditions have been met.

DFSKBLA8 calls DFSKBLAS to format the output.

Unrecognized characters or invalid parameter specifications are ignored by this routine.

The possible subparameters of PARM= are:

XFMT=

Extends the X'50' log record format to enhance the retrievability of certain data entries. N is the default.

Y Highlights the log data for certain types of processing by placing the data on a separate line and adding identifiers for data entries. It applies to log data that describes the following types of processing: data sharing, XRF buffer and lock tracking, space management, key, backout (undo), and recovery (redo). If a type of processing is not relevant, the data section is omitted.

These data sections are added after the unformatted log data for the record. Each section includes identifiers followed by hexadecimal log data, character log data, or both. They contain the following entries, where X represents hexadecimal log data and C represents character log data:

Data sharing

```
DSHRDSSN XXXXXXXX DSHRLSN XXXXXXXXXXXX DSHRUSID
XXXXXXXX RACF-UID CCCCCCCC XXXXXXXXXXXXXXXX
```

XRF buffer and lock tracking

```
TRAKPLSZ XXXX TRAKBUFN XXXX TRAKHASH XXXXXXXX
TRAKLOCK XXXXXXXX TRAKFLGS XX XX
```

Space management

```
SMGTFLGS XX XX SMGTROFF XXXX SMGTRLEN XXXX
```

Key

```
KSDS  Character string describing database action
LENGTH XXXX
One or more lines of mixed hexadecimal and character data
```

Undo

```
UNDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

Redo

```
REDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

N Does not highlight the log data for data sharing, buffer and lock tracking, space management, key, backout or recovery. The data is formatted as part of the raw data for the record.

PST=*pst_number*
Selects records containing the PST number.

SYSID=*system_id*
Selects records for the system ID portion of recovery token.

TOKEN=*token*
Selects records for the hexadecimal token portion of recovery token. You can select the following record types: X'07', X'08', X'0A', X'13', X'27', X'28', X'31', X'32', X'35', X'37', X'38', X'39', X'3D', X'41', X'4C', X'50', X'56', X'59', X'5901', X'5903', X'5937', and X'5938'.

PSB=*psb_name*
Selects records for the PSB name.

DBD=*dbd_name*
Selects records for the DBD name.

RBA=*rba_value*
Selects records for the RBA logical record length (LRECL).

BLOCK=*block_rba*
Selects records for the RBA (block).

USERID=*userid*
Selects records for the user id.

KEY=*ksds_key*
Selects records for the key.

OFFSET=*offset*
Selects records that update a given offset of data in the buffer.

UNDO=*undo_data*
Selects records for backout data that matches the character string you specify. The maximum length of the character string is 255 characters.

REDO=*redo_data*
Selects records with recovery data that matches the character string you specify. The maximum length of the character string is 255 characters.

DATA=*log_data*
Selects records with data, including compressed data, that matches the character string you specify (searches all log records). The maximum length of the character string is 255 characters.

KBLA Knowledge-Based Record Formatting Module (DFSKBLA9)

Use the KBLA Knowledge-Based Record Formatting module (DFSKBLA9) to:

- Produce expanded log records from compressed IMS logs.
- Select and format X'5' (DL/I 5X and fast path 5950) log records based on data contained within the record itself, such as the contents of a time, date, or identification field. These records are formatted along with all log record types listed under the PARM TOKEN= description.
- Change the format of log output to identify and emphasize some optional log fields

Specify the search criteria for the routine as subparameters of the PARM= parameter of the OPTION statement for the File Select and Formatting Print utility (DFSERA10). Each subparameter must be uppercase and not have any blanks. The subparameter data must be character or decimal. Hexadecimal data must be preceded by an X and the data enclosed in single quotes (for example, X'0123').

When the record is selected, it can be written to tape or DASD.

When multiple subparameters are specified, all conditions must be met to select a record. Use multiple routines to select records if some of the conditions have been met.

DFSKBLA9 calls DFSKBLAK to format the output.

Unrecognized characters or invalid parameter specifications are ignored by this routine.

The possible subparameters of PARM= are:

XFMT=
Extends the X'50' log record format to enhance the retrievability of certain data entries. N is the default.

Y Highlights the log data for certain types of processing by placing the data on a separate line and adding identifiers for data entries. It applies to log data that describes the following types of processing: data sharing, XRF buffer and lock tracking, space management, key, backout (undo), and recovery (redo). If a type of processing is not relevant, the data section is omitted.

These data sections are added after the unformatted log data for the record. Each section includes identifiers followed by hexadecimal log data, character log data, or both. They contain the following entries, where X represents hexadecimal log data and C represents character log data:

Data sharing

```
DSHRDSSN XXXXXXXX DSHRLSN XXXXXXXXXXXX DSHRUSID
XXXXXXXX RACF-UID CCCCCCCC XXXXXXXXXXXXXXXX
```

XRF buffer and lock tracking

```
TRAKPLSZ XXXX TRAKBUFN XXXX TRAKHASH XXXXXXXX
TRAKLOCK XXXXXXXX TRAKFLGS XX XX
```

Space management

```
SMGTFLGS XX XX SMGTROFF XXXX SMGTRLEN XXXX
```

Key

```
KSDS  Character string describing database action
LENGTH XXXX
One or more lines of mixed hexadecimal and character data
```

Undo

```
UNDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

Redo

```
REDO  Character string describing database action
LENGTH XXXX  OFFSET XXXX
One or more lines of mixed hexadecimal and character data
```

N Does not highlight the log data for data sharing, buffer and lock tracking, space management, key, backout or recovery. The data is formatted as part of the raw data for the record.

PST=pst_number
Selects records containing the PST number.

SYSID=system_id
Selects records for the system ID portion of the recovery token.

TOKEN=token
Selects records for the hexadecimal token portion of the recovery token. You can select the following record types: X'07', X'08', X'0A', X'13', X'27', X'28', X'31', X'32', X'35', X'37', X'38', X'39', X'3D', X'41', X'4C', X'50', X'56', X'59', X'5901', X'5903', X'5937', and X'5938'.

PSB=*psb_name*
Selects records for the PSB name.

DBD=*dbd_name*
Selects records for the DBD name.

RBA=*rba_value*
Selects records for the RBA logical record length (LRECL).

BLOCK=*block_rba*
Selects records for the RBA block.

USERID=*userid*
Selects records for the user id.

KEY=*ksds_key*
Selects records for the key.

OFFSET=*offset*
Selects records that update a given offset of data in the buffer.

UNDO=*undo_data*
Selects records for backout data that matches the character string you specify. The maximum length of the character string is 255 characters.

REDO=*redo_data*
Selects records with recovery data that matches the character string you specify. The maximum length of the character string is 255 characters.

DATA=*log_data*
Selects records with data, including compressed data, that matches the character string you specify (searches all log records). The maximum length of the character string is 255 characters.

KBLA Summary Record Formatting and Print Module (DFSKBLAS)

Use the KBLA Summary Record Formatting and Print Module (DFSKBLAS) to format traces and general purpose record types. DFSKBLAS is an exit routine of the File Select and Formatting Print Utility (DFSERA10). Because this routine formats log records, it passes a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing.

For IMS log records, NODE trace entries and SNAP subrecord types, DFSKBLAS creates and print only the log record header information describing what the log record identifier represents, the log sequence number of the record (LSN), and the time stamp at which the record was written.

If you are using the KBLA panel driven interface for formatting log records, specify formatting option S (for Summary) to generate the control statement necessary to run this routine. Figure 218 is an example of the KBLA panel drive interface.

```
.  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
             == K.B.L.A.  Log Record Formatting ==
COMMAND ===>


Input IMS Log DSN IMS.SAMPLE.LOG                          Cataloged? Y

IMS Log Version. . . . . 9
Extract Record(s). . . . .                                     (eg. 01 02 5912)

Log Formatting Type. . . . S             (B,S,K or U)
Output DSN Keyword . . . . TEST
                                         Output DSN: USERID.Keyword.KBLA
Optional parameters
  Print /TRA Log Record. . N             (Y/N)
  Print Internal Traces. . N             (Y/N)
  Filter by Keyword. . . . X'08000C3D'
  No. Records to Scan. . .
  No. Records to Skip. . .

  Log DSNs were extracted from RECON.
  PDS member containing logs . . . . .
```

Figure 218. KBLA Log Record Formatting Panel to Invoke DFSKBLAS

Utility Control Statements for DFSKBLAS

Figure 219 on page 521 shows the control statements required to format type X'67aa', X'03', and X'16' log records using the DFSKBLAS module.

```
Column 1     Column 10     Column 16                      72

CONTROL      CNTL
OPTION       PRINT         OFFSET=5,FLDLEN=2,              X
                               VALUE=67aa,COND=E,                X
                           EXITR=DFSKBLAS
OPTION       PRINT         OFFSET=5,FLDLEN=1,              X
                           VALUE=03,COND=E,              X
                           EXITR=DFSKBLAS
OPTION       PRINT         OFFSET=5,FLDLEN=1,              X
                           VALUE=16,COND=E,              X
                           EXITR=DFSKBLAS
END
```

Figure 219. Control Statements Required for DFSKBLAS

In Figure 219, `aa` is the log record subtype.

aa=01 Specifies TRACE log record subtype. NODE trace entries are interpreted.

aa=FD Specifies SNAP log record subtype.

aa=FF Specifies ABEND log record subtype.

Output for DFSKBLAS

Figure 220 shows a sample formatted log print from DFSKBLAS.

```
16 RECORD  VTAM TERMINAL /SIGN ON                    LSN: 0000020C     DATE/TIME: 2003-07-10   20:27:17.350994 UTC
01 RECORD  INPUT MESSAGE QUEUED                      LSN: 00000211     DATE/TIME: 2003-07-10   20:27:17.355413 UTC
03 RECORD  INPUT MESSAGE QUEUED                      LSN: 00D00214     DATE/TIME: 2003-07-10   20:27:17.404156 UTC
01 RECORD  INPUT MESSAGE QUEUED                      LSN: 00000219     DATE/TIME: 2003-07-10   20:27:17.413053 UTC
 TRACE     ID = D 07  OPNDST-LOGON/CLSDST-LOGOFF     RECNO = 000008FF  DATE/TIME: 2003-07-10   20:27:17.422532 UTC
 TRACE     ID = C 08  GET OUTPUT BUFFER FOR MSG      RECNO = 00000900  DATE/TIME: 2003-07-10   20:27:17.422542 UTC
 TRACE     ID = A 05  IMS SENDS OUTPUT               RECNO = 00000903  DATE/TIME: 2003-07-10   20:27:17.422550 UTC
 TRACE     ID = D 07  OPNDST-LOGON/CLSDST-LOGOFF     RECNO = 00000905  DATE/TIME: 2003-07-10   20:27:17.422611 UTC
 TRACE     ID = C 08  GET OUTPUT BUFFER FOR MSG      RECNO = 00000906  DATE/TIME: 2003-07-10   20:27:17.422733 UTC
 TRACE     ID = A 05  IMS SENDS OUTPUT               RECNO = 00000909  DATE/TIME: 2003-07-10   20:27:17.422781 UTC
01 RECORD  INPUT MESSAGE QUEUED                      LSN: 00000911     DATE/TIME: 2003-07-10   20:27:17.423002 UTC
 TRACE     ID = D 07  OPNDST-LOGON/CLSDST-LOGOFF     RECNO = 0000091C  DATE/TIME: 2003-07-10   20:27:17.423102 UTC
16 RECORD  VTAM TERMINAL /SIGN ON                    LSN: 00001005     DATE/TIME: 2003-07-10   20:27:17.423234 UTC
 TRACE     ID = A 05  IMS SENDS OUTPUT               RECNO = 00001217  DATE/TIME: 2003-07-10   20:27:17.423331 UTC
 TRACE     ID = D 07  OPNDST-LOGON/CLSDST-LOGOFF     RECNO = 00001219  DATE/TIME: 2003-07-10   20:27:17.423599 UTC
16 RECORD  VTAM TERMINAL /SIGN ON                    LSN: 0001220C     DATE/TIME: 2003-07-10   20:27:17.423937 UTC
```

Figure 220. Sample Formatted Log Print from DFSKBLAS

KBLA Knowledge-Based Record Formatting and Print Module (DFSKBLAK)

Use the KBLA Knowledge-Based Record Formatting and Print Module (DFSKBLAK) to format traces and general purpose record types. DFSKBLAK is an exit routine of the File Select and Formatting Print Utility (DFSERA10). Because this routine formats log records, it passes a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing.

DFSKBLAK formatted output records are intended to be a clear and simple, somewhat generic description of the event that generated the record itself. For most of the IMS log records, DFSKBLAK prints a description of what the log record identifier represents, the log sequence number of the record (LSN), and the time stamp at which the record was written. Not all the record's bytes and flags are

interpreted and printed by DFSKBLAK, and your analysis might require a different formatting output than the one produced by this routine.

Note: Numeric values are always expressed in hexadecimal format unless otherwise stated.

If you are using the KBLA panel driven interface for formatting log records specify formatting option K (for Knowledge Based) to generate the control statement necessary to run this routine. Figure 221 is an example of the KBLA panel driven interface used to invoke DFSKBLAK.

```
.  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .
             == K.B.L.A.  Log Record Formatting ==
COMMAND ===>


Input IMS Log DSN IMS.SAMPLE.LOG                          Cataloged? Y

IMS Log Version. . . . . 9
Extract Record(s). . . . .                                     (eg. 01 02 5912)

Log Formatting Type. . . . K             (B,S,K or U)
Output DSN Keyword . . . . TEST
                                         Output DSN: USERID.Keyword.KBLA
Optional parameters
  Print /TRA Log Record. . N             (Y/N)
  Print Internal Traces. . N             (Y/N)
  Filter by Keyword. . . . X'08000C3D'
  No. Records to Scan. . .
  No. Records to Skip. . .

  Log DSNs were extracted from RECON.
  PDS member containing logs . . . ..
```

Figure 221. KBLA Log Record Formatting Panel to Invoke DFSKBLAK

Utility Control Statements for DFSKBLAK

Figure 222 shows an example of the control statements required to format type X'03', X'16', and X'35' log records using the DFSKBLAK exit routine.

```
Column 1     Column 10     Column 16                        72

CONTROL      CNTL
OPTION       PRINT         OFFSET=5,FLDLEN=1,                X
                               VALUE=03,COND=E,                X
                           EXITR=DFSKBLAK
OPTION       PRINT         OFFSET=5,FLDLEN=1,                X
                           VALUE=16,COND=E,                X
                           EXITR=DFSKBLAK
OPTION       PRINT         OFFSET=5,FLDLEN=1,                X
                           VALUE=35,COND=E,                X
                           EXITR=DFSKBLAK
END
```

Figure 222. Control Statements Required for DFSKBLAK

In this figure, `aa` is the log record subtype.

aa=01 Specifies the TRACE log record subtype. NODE trace entries are interpreted.

aa=FD Specifies the SNAP log record subtype.

aa=FF Specifies the ABEND log record subtype.

Output for DFSKBLAK

Figure 223 shows a sample formatted log from DFSKBLAK.

```
03 RECORD    OUTPUT MESSAGE QUEUED
     NODE NAME: N/A            SOURCE QAB: 2931D460   DEST LTERM/TRAN: TC670910
    ORIGIN IMS: TI1T       PROCESSING IMS: TI1T         MSG TIMESTAMP: 2003191 20270152
     1ST/CURRENT DRRN: 08000006/08000006
     UOW: E3C9F1E340404040B9B30901C1D84482E3C9F1E340404040B9B30906C90B2F224000
     DATE/TIME: 2003-07-10 20:27:17.350994 UTC             LOG SEQ NO: 00DFB20C

03 RECORD    OUTPUT MESSAGE QUEUED
     NODE NAME: N/A            SOURCE QAB: 2931D460   DEST LTERM/TRAN: TC670910
    ORIGIN IMS: TI1T       PROCESSING IMS: TI1T         MSG TIMESTAMP: 2003191 20270152
     1ST/CURRENT DRRN: 0800000C/0800000C
     UOW: E3C9F1E340404040B9B3090111CE2D44E3C9F1E340404040B9B3091019F62A048000
     DATE/TIME: 2003-07-10 20:27:17.355413 UTC             LOG SEQ NO: 00DFB211

35 RECORD    MSG WAS ENQUEUED/RE-ENQUEUED
     CALL TYPE: ENQ COMM FIFO          DESCRIPTION: PERMANENT DEST IS TRAN
     QUEUE #: N/A            PCB ADDR: 131B5DE8            DEST  TRAN: TC670910
     CQSPUT                  MESSAGE MOVED TO SQ           DRRN: 0800000C
     UOW: E3C9F1E340404040B9B3090111CE2D44E3C9F1E340404040B9B3091019F62A048000
     DATE/TIME: 2003-07-10 20:27:17.355422 UTC             LOG SEQ NO: 00DFB212

16 RECORD    TERMINAL SIGN ON/OFF
     FUNC: VTAM /SIGN OFF FORCED     NODE: M0301016  USERID: ZZKP2
     SAF GRP NAME:                           USER STR NAME: M0301016
     USER ALLOC/DEALLOC DONE
     DATE/TIME: 2003-07-10 20:32:33.680372 UTC             LOG SEQ NO: 00DFCC47
```

Figure 223. Sample Formatted Log from DFSKBLAK

Chapter 25. DBCTL Transaction Analysis Utility (DFSKDBC0)

The DBCTL Transaction Analysis utility (DFSKDBC0) combines some of the information found in the DBFULTA0 and DFSILTA0 utilities plus some additional DBCTL specific information. By default, the output is presented in termination (sync point) time order, but it can be sorted by specific key fields to help identify potential performance problems.

DFSKDBC0 runs as an exit routine of the File Select and Formatting Print utility (DFSERA10). DFSKDBC0 can also be invoked using the KBLA panel driven interface (option 4.6 “DBCTL Transaction Analysis”). Figure 224 is an example of the DBCTL Transaction Analysis panel in the KBLA panel-driven interface.

```
             == K.B.L.A.  DBCTL Transaction Analysis =
COMMAND ===>

Input IMS Log DSN IMS.SAMPLE.LOG                        Cataloged? Y
IMS Log Version. . . . . . . . . . . . 9

 Transaction Summary Report Sorted by:
        DLI I/O Time . . . . . . . . . N   (A/D/N)
        NBA Buffers Used . . . . . . . N   (A/D/N)
        PSBNAME . . . . . . . . . . . N   (A/D/N)
        Scheduling Elapsed Time. . . . N   (A/D/N)
        SYNC Failure . . . . . . . . . N   (A/D/N)
        Time Waiting for DEDB BUFFER . N   (A/D/N)
        Time Waiting for INTENT. . . . N   (A/D/N)
        Time Waiting for POOL SPACE. . N   (A/D/N)
        Time Waiting for LOCKS . . . . N   (A/D/N)
        Time Waiting for CI LOCK . . . N   (A/D/N)
        Time Waiting for UOW LOCK. . . N   (A/D/N)

Output DSN  Keyword. . . . . . . . . . TEST     The Output DSN will be:
                                                USERID.keyword.KBLA.*
Log DSNs were extracted from RECON . .
PDS member containing logs . . . . . .
```

Figure 224. KBLA DBCTL Transaction Analysis Panel

DFSKDBC0 formats log records by passing a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing. For more information on DFSERA10, see Chapter 13, “File Select and Formatting Print Utility (DFSERA10),” on page 295.

DFSKDBC0 should be used primarily for DBCTL environments because it relies on the X'07' application accounting record and any corresponding X'5937/5938' records to gather statistical information. In a DBCTL environment, the X'07' record is always written for any CICS transaction using IMS resources, so there is a one to one correspondence. In an IMS TM environment, many transactions can be processed in a single application scheduling, making the output unpredictable unless a PROCLIM of 1 is specified.

You can use the output report information to find bottlenecks in the system and to evaluate whether resources have been assigned and sized correctly. The report produced is also useful for IMS system tuning and troubleshooting. DFSKDBC0 is put into IMS.SDFSRESL during IMS system definition.

The following topics provide additional information:

- “Restrictions for DFSKDBC0” on page 526

Related Reading: See Chapter 14, "Fast Path Log Analysis Utility (DBFULTA0)," on page 325 and Chapter 16, "Log Transaction Analysis Utility (DFSILTA0)," on page 353 for more information.

Restrictions for DFSKDBC0

The following restrictions apply to the DBCTL Transaction Analysis utility (DFSKDBC0):

- The utility works only with input log data sets created by the same release of IMS as the utility release level.
- Logs from other than a DBCTL environment are not supported.

Input and Output for DFSKDBC0

DFSKDBC0 requires at least one IMS log data set. Additional data sets are optional.

DFSKDBC0 produces the following output:

- When KBLA panels are used, a sorted report containing the information described in the overview section can optionally be requested in the order specified (ascending or descending).
- If the utility is invoked directly, the output reports the following information:
  - Elapsed time in scheduling
  - Time waiting for intent
  - Total full function calls
  - Total DL/I I/O count
  - DL/I I/O time
  - Total DEDB calls
  - DEDB get calls
  - Buffers sent to OTHREAD
  - Buffers used for SDEP
  - UOW lock waits
  - VSO reads from data space
  - Updates to VSO data space
  - Sync failure codes
  - Time waiting for pool space
  - Time waiting for locks
  - DEDB put calls
  - NBA buffers used
  - CI lock waits
  - VSO reads from DASD

JCL Requirements for DFSKDBC0

DFSKDBC0 runs as an exit of the File Select and Formatting Print utility (DFSERA10), which executes as a standard operating system job. You must define a JOB statement, an EXEC statement, and DD statements defining input and output.

The format of the EXEC statement is:

```
//SELPRT1   EXEC PGM=DFSERA10
```

DD Statements

STEPLIB DD

Points to IMS.SDFSRESL, which contains the IMS nucleus and required utility modules. The format is:

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

SYSPRINT DD

Describes the output data set to contain the formatted print records and control messages. It is usually defined as SYSOUT=A.

SYSIN DD

Describes the input control data set. This file must contain fixed-length 80-character records.

To run DFSKDBC0, specify the DFSERA10 parameter EXITR= or E= as follows:

```
//SYSIN     DD  *
CONTROL  CNTL  H=EOF
OPTION   PRINT E=DFSKDBC0
/*
```

Related Reading: For more information about the DFSERA10 control statement, see “CONTROL Statement” on page 298.

SYSUT1 or ddname

Defines the IMS Version 9 input log data set to be examined to produce the formatted print records.

These data sets must be files with standard labels, either on a direct-access or tape storage device. They can be of any record format (RECFM=F, FB, V, VB, VBS, or U), but they must have physical sequential organization (DSORG=PS).

If a file with RECFM=U is used, the DCB BLKSIZE parameter must be specified. These files are processed using QSAM. Any file that QSAM supports can be used as input.

If the DDNAME= keyword is not specified in the CONTROL statement, the default ddname is SYSUT1.

Using DFSKDBC0 to Sort a Report

The sort function of the DBCTL Transaction Analysis utility is an optional function that produces sequenced reports.

The format of the EXEC statement is:

```
//STEP1  EXEC  PGM=SORT
```

DD Statements

SYSIN DD
Describes the sort program's control data set. For a control data set in the input stream, the format is:

```
//SYSIN  DD  *
```

SYSOUT DD
Describes the message output data set for the sort. The format is:

```
//SYSOUT DD SYSOUT=A
```

SORTIN DD
Describes the input data set to the sort. It is the data set described by the SYSPRINT DD statement. The format is:

```
//SORTIN  DD  DSNAME=&&REPORT,DISP=(OLD,DELETE)
```

SORTOUT DD
Describes the output data set to the sort. It is used for printing a sequenced report. The format is:

```
//SORTOUT  DD SYSOUT=A
```

SORTWK01-12|DD
Describes the sort program's work data sets. At least three data sets must be used. They can reside on tape or disk. For disk, the format is:

```
SORTWKnn  DD  UNIT=SYSDA,SPACE=(CYL,(5),,CONTIG)
```

Example of DFSKDBC0

Figure 225 is a sample SORT control statement that provides a report sequenced by message get unique (GU) schedule time within a region:

```
SORT FIELDS=(64,5,CH,A)
```

Figure 225. Sample SORT Control Statement

Figure 226 on page 529 is an example of a report produced using the DBCTL Transaction Analysis utility.

```
CONTROL  CNTL  H=EOF
************************************************
* IMS-V9 INPUT LOG DATA SET NAME(S):           *
* IMSVS.TEST.LOG                               *
************************************************
*                                              *
* DBCTL TRANSACTION ANALYSIS                   *
*                                              *
************************************************
OPTION   PRINT E=DFSKDBC0
COLUMN HEADING EXPLANATIONS:
SCHEL - ELAPSED TIME IN SCHEDULING    INT - TIME WAITING FOR INTENT    PWT - TIME WAITING FOR POOL SPACE
DLI   - TOTAL FULL FUNCTION CALLS     IOT - DLI I/O TIME               LWT - TIME WAITING FOR LOCKS
DEC   - TOTAL DEDB CALLS              DEG - DEDB GET CALLS             DEP - DEDB PUT CALLS
OVF   - OVERFLOW BUFFERS USED         BWT - DEDB BUFFER WAITS          NBA - NBA BUFFERS USED
UPD   - BUFFERS SENT TO OTHREAD       SDP - BUFFERS USED FOR SDEP      CLK - CI LOCK WAITS
ULK   - UOW LOCK WAITS                VRD - VSO RADS FROM DATA SPACE   VDR - VSO READS FROM DASD
VWR   - UPDATES TO VSO DATA SPACE     S/F - SYNC FAILURE CODE - SEE UTILITIES REF MANUAL FOR EXPLANATION
PSBNAME    SUBSYS R RGN ELAP SCHED_TIME SCHEL INT PWT DLI   IOT    LWT DEC DEG DEP OVF BWT NBA UPD SDP CLK ULK VRD VDR VWR S
               ID T NBR SS.T HH:MM:SS.T    MS  MS  MS   #    MS     MS   #   #   #   #   #   #   #   #   #   #   #   #   # F
TXSQL6C  SYS6         2  1.3 18:18:21.9                 0                0   0   0   0   0   0   0   0   0   0   0   0   0
TXSQL6C  SYS6         2   .5 18:18:23.5                 0                0   0   0   0   0   0   0   0   0   0   0   0   0
EMHPSB2  SYS6     B   1 13.5 18:18:12.6                 0                0   0   0   0   0   0   0   0   0   0   0   0   0 U
TXSQL6C  SYS6         2   .7 18:18:41.1                 0                0   0   0   0   0   0   0   0   0   0   0   0   0
EMHPSB2  SYS6     B   1 16.6 18:18:27.3                 0                0   0   0   0   0   0   0   0   0   0   0   0   0 L
DFS707I END OF FILE ON INPUT
NUMBER OF SYNC RECORDS  (5937)              3
NUMBER OF SYNC FAILURES (5938)              4
NUMBER OF SCHD RECORDS  (08)                5
NUMBER OF TERM RECORDS  (07)                5
DFS708I OPTION COMPLETE
DFS703I END OF JOB
```

Figure 226. Report Produced Using DFSKDBC0

For information on the meanings of values within the report, see “Detail-Listing-of-Exception-Transactions Report” on page 328.

Chapter 26. IMS Records User Data Scrub Utility (DFSKSCR0)

The IMS Records User Data Scrub utility (DFSKSCR0) scans all the IMS log records and eliminates those parts of the records that contain sensitive or confidential user data such as customer business information. DFSKSCR0 specifically removes log records X'01', X'03', X'50', X'5901', X'5903', X'5950', and X'67'. IMS-defined headers and suffixes, as well as the actual length of the log record, are kept intact to provide debugging or statistical information. DFSKSCR0 can be particularly useful when IMS logs must be sent to an outside organization for analysis.

DFSKSCR0 can be invoked using the KBLA panel-driven interface (option 1.7 “IMS Records User Data Scrub”) or using JCL. Figure 227 is an example of the IMS Records User Data Scrub panel in the KBLA panel-driven interface.

```
. . . . . .
            IMS K.B.L.A. - IMS Records User Data Scrub
 Command ===>


 Fill out the following variables and press ENTER .

 Input IMS Log DSN IMS.SAMPLE.LOG                        Cataloged? Y
 IMS Log Version . . . . 9

 Output DSN Keyword . .  TEST     Output DSN: USERID.Keyword.KBLA.STS.*


 Create a New Log dataset with no User Data. . Y  (Y/N)
```

Figure 227. KBLA IMS Records User Data Scrub Panel

DFSKSCR0 runs as an exit routine of the File Select and Formatting Print Utility (DFSERA10). Because this routine formats log records, it passes a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing. For more information about DFSERA10 JCL requirements, see “JCL Requirements for DFSERA10” on page 296.

The following topics provide additional information:

- “Restrictions for DFSKSCR0”
- “Input and Output for DFSKSCR0”
- “JCL Requirements for DFSKSCR0” on page 532

Restrictions for DFSKSCR0

The following restrictions apply to DFSKSCR0:

- Common Queue Server (CQS) logs cannot be used as input.
- The utility works only with input log data sets created by the same release of IMS as the utility release level.

Input and Output for DFSKSCR0

One or more IMS log data sets are required as input for DFSKSCR0.

DFSKSCR0 produces the following output:

- An image of the INPUT IMS log data set without user information (OPTION COPY statement for DFSERA10)
- A printed output of the records for verification (OPTION PRINT statement for DFSERA10)

JCL Requirements for DFSKSCR0

DFSKSCR0 runs as an exit routine to the File Select and Formatting Print utility (DFSERA10), which executes as a standard operating system job. You must define a JOB statement, an EXEC statement, and DD statements defining input and output.

The format of the EXEC statement is:

```
//SELPRT1   EXEC PGM=DFSERA10
```

DD Statements

STEPLIB DD

Points to IMS.SDFSRESL, which contains the IMS nucleus and required utility modules. The format is:

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

SYSPRINT DD

Describes the output data set to contain the formatted print records and control messages. It is usually defined as SYSOUT=A.

SYSIN DD

Describes the input control data set. This file must contain fixed-length 80-character records.

To run DFSKSCR0, specify the DFSERA10 parameter EXITR= or E= as follows:

```
//SYSIN     DD  *
CONTROL  CNTL  H=EOF
OPTION   PRINT E=DFSKSCR0
/*
```

Related Reading: For more information about the DFSERA10 control statement, see “CONTROL Statement” on page 298.

SYSUT1 or ddname

Defines the IMS Version 9 input log data set to be examined to produce the formatted print records. These data sets must be standard labeled files, on either direct-access or tape storage device. They can be of any record format (RECFM=F, FB, V, VB, VBS, or U), but they must have physical sequential organization (DSORG=PS).

If a file with RECFM=U is used, the DCB BLKSIZE parameter must be specified. These files are processed using QSAM. Any file that QSAM supports can be described as input.

If the DDNAME= keyword is not specified in the CONTROL statement, the default ddname used is SYSUT1.

Example of DFSKSCR0

Figure 228 on page 533 is an example of a report produced using the IMS Records User Data Scrub utility.

```
CONTROL  CNTL  STOPAFT=EOF
************************************************
* IMS-V9 INPUT LOG DATA SET NAME(S):           *
* IMSVS.TEST.LOG
************************************************
*                                              *
* RECORDS USER DATA SCRUB                      *
*                                              *
************************************************
OPTION   COPY E=DFSKSCR0
*
DFS707I END OF FILE ON INPUT
#01   RECORDS PROCESSED:             3
#03   RECORDS PROCESSED:            16
#50   RECORDS PROCESSED:             0
#5901 RECORDS PROCESSED:             2
#5903 RECORDS PROCESSED:             2
#5950 RECORDS PROCESSED:             0
#67   RECORDS PROCESSED:             7
DFS708I OPTION COMPLETE
DFS703I END OF JOB
```

Figure 228. Report Produced Using DFSKSCR0

Chapter 27. MSC Link Performance Formatting Utility (DFSKMSC0)

The MSC Link Performance Formatting utility (DFSKMSC0) uses the IMS MSC link trace log records to provide information about link response times, which can be used to help isolate performance problems with MSC links.

DFSKMSC0 runs as an exit routine of the File Select and Formatting Print Utility (DFSERA10). DFSKMSC0 can be invoked using the KBLA panel-driven interface (option 4.2 “MSC Link Performance Formatting”) or using JCL. Figure 229 is an example of the MSC Link Performance Formatting utility panel in the KBLA panel-driven interface.

```
. . . . . .
             == K.B.L.A.  MSC Link Performance Formatting ==
COMMAND ===>


Input IMS Log DSN IMS.SAMPLE.LOG                        Cataloged? Y
IMS Log Version. . . . . 9


Output DSN  Keyword. . . . TEST    The Output DSN will be:
                                      USERID.keyword.KBLA
Log DSNs were extracted from RECON.
PDS member containing logs. . . . .



 Log DSNs were extracted from RECON . .
 PDS member containing logs . . . . .
```

Figure 229. KBLA MSC Link Performance Formatting Panel

DFSKMSC0 formats log records by passing a return code to DFSERA10. The return code tells DFSERA10 that the log record has been processed and requires no additional processing. For more information on DFSERA10, see Chapter 13, “File Select and Formatting Print Utility (DFSERA10),” on page 295. The formatting of these records is only available if the IMS input log contains MSC link trace activity.

The following topics provide additional information:

- “Restrictions for DFSKMSC0”
- “Input and Output for DFSKMSC0” on page 536
- “JCL Requirements for DFSKMSC0” on page 536

Restrictions for DFSKMSC0

The following restrictions apply to DFSKMSC0:

- Common Queue Server (CQS) logs cannot be used as input.
- The utility works only with input log data sets created by the same release of IMS as the utility release level.

Input and Output for DFSKMSC0

One or more IMS log data sets containing log record X'6701' are required as input for DFSKMSC0. X'6701' log records are generated using the command:

```
/TRACE SET ON LINK link#
```

DFSKMSC0 produces two types of output reports:

- A detailed report in which an output line is produced for every send or receive for each MSC link that was traced. The times reported are to the millisecond.
- A summary report that shows the average time in milliseconds for each of the MSC links traced. This report can show whether a problem is isolated to a specific link or is common to all links.

JCL Requirements for DFSKMSC0

DFSKMSC0 runs as an exit routine of the File Select and Formatting Print utility (DFSERA10), which executes as a standard operating system job. You must define a JOB statement, an EXEC statement, and DD statements defining the input and output.

The format of the EXEC statement is:

```
//SELPRT1   EXEC PGM=DFSERA10
```

DD Statements

STEPLIB DD
Points to IMS.SDFSRESL, which contains the IMS nucleus and required utility modules. The format is:

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

SYSPRINT DD
Describes the output data set to contain the formatted print records and control messages. It is usually defined as SYSOUT=A.

SYSIN DD
Describes the input control data set. This file must contain fixed-length 80-character records.

SYSUT1 or ddname
Defines the IMS Version 9 input log data set to be examined to produce the formatted print records. These data sets must be files with standard labels, on either direct-access or tape storage device. They can be of any record format (RECFM=F, FB, V, VB, VBS, or U), but they must have physical sequential organization (DSORG=PS).

If a file with RECFM=U is used, the DCB BLKSIZE parameter must be specified. These files are processed using QSAM. Any file that QSAM supports can be described as input.

If the DDNAME=keyword is not specified in the CONTROL statement, the default ddname used is SYSUT1. To run DFSKMSC0, specify the DFSERA10 parameter EXITR= or E= as follows:

```
//SYSIN     DD  *
CONTROL  CNTL  H=EOF
OPTION   PRINT E=DFSKMSC0
/*
```

Related Reading: For more information about the DFSERA10 control statement, see "CONTROL Statement" on page 298.

Example of DFSKMSC0

Figure 230 is an example of a report produced using the MSC Link Performance Formatting utility.

```
CONTROL  CNTL  STOPAFT=EOF
************************************************
* IMS-V9 INPUT LOG DATA SET NAME(S):           *
* IMSVS.TEST.LOG
************************************************
*                                              *
* MSC TRACE SELECTION                          *
                                               *
************************************************
OPTION   PRINT E=DFSKMSC0
*
                    RECV DATA TO ACK (MS)                 SEND DATA TO ACK (MS) SEND CHECK WRITE (MS)          TIME
RECV FOR ID = WB                         6                                                              11:38:29.652
SEND FOR ID = WB                                                              13                    23   11:38:29.693
RECV FOR ID = WB                         8                                                              11:38:29.775
SEND FOR ID = WB                                                               6                    21   11:38:29.804
SEND FOR ID = WB                                                              14                    28   11:38:29.849
RECV FOR ID = WB                        28                                                              11:38:29.883
RECV FOR ID = WB                        13                                                              11:38:29.924
SEND FOR ID = WB                                                              26                    21   11:38:29.985
RECV FOR ID = WB                        14                                                              11:38:30.026
RECV FOR ID = WB                         5                                                              11:38:30.089
SEND FOR ID = WB                                                              13                    21   11:38:30.136
RECV FOR ID = WB                        24                                                              11:38:30.162
RECV FOR ID = WB                         8                                                              11:38:30.219
LINK PARTNER NAME    RECV DATA TO ACK (MS) # RECV SAMPLES SEND DATA TO ACK (MS) SEND CHECK WRITE (MS) # SEND SAMPLES
               WB                        15          1,041                    23                    22            667
```

Figure 230. Report Produced Using DFSKMSC0

Chapter 28. Statistic Log Record Analysis Utility (DFSKDVS0)

The Statistic Log Record Analysis utility (DFSKDVS0) processes the X'45' log records generated at each IMS checkpoint and formats a report showing the detailed statistic information between each pair of checkpoints. This information can be used to look for bottlenecks within the IMS system or to detect trends in internal resource usage that can help to determine if tuning is necessary. DFSKDVS0 can be used in DB/TM, DBCTL, or DCCTL environments.

DFSKDVS0 runs as an exit routine of the File Select and Formatting Print Utility (DFSERA10). DFSKDVS0 can also be invoked using the KBLA panel driven interface (option 4.3 “Statistic Log Record Analysis”). Figure 231 is an example of the KBLA Statistic Log Record Analysis panel in the KBLA panel-driven interface.

```
== K.B.L.A.  Statistic Log Record Analysis ==
 COMMAND ===>


 Input IMS Log DSN IMS.SAMPLE.LOG                      Cataloged? Y
 IMS Log Version. . . . . . . . . 9


 Output DSN  Keyword. . . . . . . TEST      The Output DSN will be:
                                              USERID.keyword.KBLA
 Log DSNs were extracted from RECON.
 PDS member containing logs. . . . .
```

Figure 231. KBLA Statistic Log Record Analysis Panel

DFSKDVS0 formats log records by passing a return code to DFSERA10. This return code tells DFSERA10 that the log record has been processed and requires no additional processing. For more information about DFSERA10 JCL requirements, see “JCL Requirements for DFSERA10” on page 296.

The following topics provide additional information:

- “Restrictions for DFSKDVS0”
- “Input and Output for DFSKDVS0” on page 540
- “JCL Requirements for DFSKDVS0” on page 540

Restrictions for DFSKDVS0

The following restrictions apply to DFSKDVS0:

- DFSKDVS0 does not process log data sets from a batch region.
- There must be at least two sets of X'45' records (created at IMS Checkpoint) for any output to be produced.
- IRLM statistics records are not produced by an IMS STATISTICS checkpoint. Therefore, the report program cannot provide any information regarding this function.
- Common Queue Server (CQS) logs cannot be used as input.
- DFSKDVS0 works only with input log data sets created by the same release of IMS as the utility release level.
- If multiple input logs are concatenated as input, they must be in sequence and without gaps or the output is unpredictable.

Input and Output for DFSKDVS0

One or more IMS log data sets (OLDS or SLDS) containing at least two sets of statistics records (generated at IMS checkpoint) are required as input for DFSKDVS0.

DFSKDVS0 produces an output report that can include:

- Time of checkpoints
- System configuration
- QPOOL statistics
- Format pool statistics
- OSAM and VSAM buffer pool activity
- Variable pool (also referred to as scheduling pool) information
- Scheduling statistics
- Logger statistics
- Program isolation information
- IMS internal latch statistics
- CBT storage pools
- Receive-any buffer usage
- Fixed storage pools (DFSSPM)
- IMS dispatcher statistics
- RACF signon statistics
- IRLM subsystem, system, and storage pool information

JCL Requirements for DFSKDVS0

DFSKDVS0 executes as a standard operating system job. You must define a JOB statement, an EXEC statement, and DD statements that define the input and output.

The format of the EXEC statement is:

```
//SELPRT1   EXEC PGM=DFSERA10
```

DD Statements

STEPLIB DD
Points to IMS.SDFSRESL, which contains the IMS nucleus and required utility modules. The format is:

```
//STEPLIB DD DSNAME=IMS.SDFSRESL,DISP=SHR
```

SYSPRINT DD
Describes the output data set to contain the formatted print records and control messages. It is usually defined as SYSOUT=A.

SYSUT1 DD
Any IMS Version 9 log or all data input is processed using QSAM. The log or data input can reside on either tape or direct-access storage devices. Data set organization must be physical sequential. The record format can be fixed or variable in length, blocked or unblocked, or of undefined length. You can use multiple input and output data sets, and they can reside on different device types. Output data can be either formatted and printed on the SYSPRINT data set, copied to a specified data set unchanged, or both.

SYSIN DD

Describes the input control data set. This file must contain fixed-length 80-character records.

Input or Data DD

Defines the input data set to be examined to produce the formatted print records. These data sets must be either direct-access or tape files with standard labels. They can be of any record format (F, FB, V, VB, VBS, or U), but they must be DSORG=PS.

If a file with RECFM=U is used, the DCB BLKSIZE parameter must be specified. These files are processed using QSAM. Any file that QSAM supports can be described as input.

If a ddname is not specified in the CONTROL statement, the default ddname used is SYSUT1. To run DFSKDVS0, specify the DFSERA10 parameter EXITR= or E=.

```
//SYSIN     DD  *
CONTROL  CNTL  H=EOF
OPTION   PRINT E=DFSKDVS0
/*
```

Related Reading: For more information about DFSERA10, see Chapter 13, “File Select and Formatting Print Utility (DFSERA10),” on page 295.

Chapter 29. IRLM Lock Trace Analysis Utilities (DFSKLTA0, DFSKLTB0, DFSKLTC0)

IRLM Lock Trace Analysis consists of three programs (DFSKLTA0, DFSKLTB0, and DFSKLTC0) that run serially to perform IRLM Lock Trace Analysis. DFSKLTA0 is run first to create the control file of global data management block (DMB) numbers and their respective database names. DFSKLTB0 is then used to create the lock wait detail and summary records. DFSKLTC0 formats and prints the information and creates the optional output data set.

The IRLM Lock Trace Analysis utilities can be useful in finding database or application issues that impact transaction response times by causing frequent and long lock waits.

Recommendation: Due to the high volume of information being recorded, run IRLM Lock Trace Analysis for only a few minutes at a time.

The IRLM Lock Trace utilities can be invoked using the KBLA panel-driven interface (option 4.5 “IRLM Lock Trace Analysis”) or using JCL. Figure 232 is an example of the IRLM Lock Trace Analysis panel in the KBLA panel-driven interface.

```
DFSKBL15      == K.B.L.A.  IRLM Lock Trace Analysis ==
 COMMAND ===>


 Input Trace DSN. IMS.SAMPLE.LOG                      Cataloged? Y
 IMS Log Version. . . . . . . . . . . 9
 RECON1 DSN . . . A.B.C

 Output DSN  Keyword. . . . . . . . . TEST       The Output DSN will be:
                                                 USERID.keyword.S.KBLA.*
 Create dataset with raw output . . .   (Y/N)    USERID.keyword.D.KBLA.*
 Raw output sort selection:
     Sorted by Database Name. . . . .     (A/D/N)
     Sorted by RBA  . . . . . . . . .     (A/D/N)
     Sorted by Database Name & RBA. . C   (A/D/C)
     Sorted by PST Number . . . . . .     (A/D/C)
     Sorted by Wait Elapsed Time. . .     (A/D/C)

 Log DSNs were extracted from RECON .
 PDS member containing logs . . . . .
```

Figure 232. KBLA Log Record Formatting Panel to Invoke DFSKLT

The following topics provide additional information:

Restrictions for IRLM Lock Trace Analysis

The following restrictions apply to IRLM Lock Trace Analysis:

- Databases must be registered with DBRC.

- The RECON database information must not have changed between the time the IMS lock trace was run and the time DFSKLTA0 was run.
- The RECON data set specified in the JCL or through the panel-driven interface must be the RECON from the system being traced.
- IRLM Lock Trace Analysis can only handle data from up to 255 active regions at a given time.

Input and Output for IRLM Lock Trace Analysis

IRLM Lock Trace Analysis is intended for IMS log records created when the following command is entered:

```
/TRACE SET ON TABLE LOCK OPTION LOG
```

Types of input required for IRLM Lock Trace Analysis include:

- One or more trace data sets (or logs) containing IMS lock trace data
- A DBRC RECON data set.

Multiple types of output are produced depending on the presence of certain DD statements:

- //TRACESUM provides a summary of lock contention.
- //DETAIL1 provides a detailed list of lock waits in lock request completion time order.
- //DETOUT1 provides a detailed lock-wait output without headers that can then be input to SORT for further detailed analysis.

Note: If no DFSTRAxx data sets are present in the IMS startup procedure, the output of the trace will be logged on the OLDS.

DFSKLTA0

DFSKLTA0 reads the DBRC RECON records to gather the global DMB numbers for the registered databases and creates a control file with this information. Any detected error is displayed as a Write-to-Operator (WTO) message. Conditions that can cause errors are:

- Unable to open RECON
- Unable to open the control data set
- RECON key length mismatch
- Error reading the RECON header
- First RECON record not a header
- Error reading the RECON record

JCL Requirements for DFSKLTA0

//KLTA0 creates the RECON control file.

The format of the EXEC statement is:

```
//KLTA0 EXEC PGM=DFSKLTA0
```

DD Statements for DFSKLTA0

COPY1 DD

Describes a valid DBRC RECON data set from the system that was used to create the trace data. For example:

```
//COPY1 DD DISP=SHR,DSN=IMSV9.RECON1
```

CONTROL DD

The output control file of DMB names and numbers. Data communications block (DCB) attributes are specified in DFSKLTA0 and should not be overridden. For example:

```
//CONTROL DD DSN=&CONTROL,DISP=(NEW,PASS),UNIT=SYSDA,SPACE=(CYL,(1,1))
```

JCL Example for DFSKLTA0

The following example shows the JCL used to run DFSKLTA0.

```
//KLTA0   EXEC PGM=DFSKLTA0,REGION=4M
//STEPLIB  DD  DSN=IMS190.SDFSRESL,DISP=SHR
//SYSUDUMP DD  SYSOUT=*
//COPY1    DD  DSN=IMS1.RECON1,DISP=SHR,
//      AMP='BUFSP=16380'
//CONTROL  DD  DSN=TSOUSR01.LOCKTRAC.CONTROL,DISP=(NEW,CATLG),
//             UNIT=SYSDA,SPACE=(TRK,(2,2))
//*
```

DFSKLTB0

DFSKLTB0 reads the lock trace data generated as a result of the `/TRA SET ON TABLE LOCK OPTION LOG` command that was issued on the IMS system at the beginning of the time period being sampled. The utility creates an intermediate file with detailed information and a summary for each lock request that resulted in a wait. Any detected errors are displayed as a WTO. Conditions that can cause errors are:

- Unable to open the TRACEIN data set
- Unable to open the TRACEOUT data set
- Unable to the control data set
- Bad return codes from the CONVTOD macro
- Internal table processing error
- Internal error that requires IBM support

JCL Requirements for DFSKLTB0

//KLTB0 reads and processes lock trace data.

The format of the EXEC statement is:

```
//KLTB0 EXEC PGM=DFSKLTB0
```

DD Statements for DFSKLTB0

TRACEIN DD

The lock trace data set created by IMS. For example:

```
//TRACEIN DD DSN=IMS.DFSTRA01,DISP=(SHR),DCB=BUFNO=10
```

Note: BUFNO is recommended for performance.

TRACEOUT DD

An intermediate data set of lock contention data to pass to the report step. For example:

```
//TRACEOUT DD DISP=(NEW,PASS),UNIT=SYSDA,DSN=&EXTRACT,
    //    DCB=BUFNO=10,SPACE=(CYL,(20,20))
```

CONTROL DD

The output control file from DFSKLTA0. For example:

```
//CONTROL DD DSN=&CONTROL,DISP=(OLD,DELETE)
```

JCL Example for DFSKLTB0

The following example shows the JCL used to run DFSKLTB0.

```
//KLTB0   EXEC PGM=DFSKLTB0,REGION=4M
//STEPLIB  DD  DSN=IMS910.SDFSRESL,LOAD,DISP=SHR
//SYSUDUMP DD  SYSOUT=*
//TRACEIN  DD  DSN=IMS1.LOCKTRACE,DISP=SHR,DCB=BUFNO=10
//TRACEOUT DD  DSN=TSOUSR01.TRACE.TEMP,UNIT=SYSDA,
//  SPACE=(CYL,(10,10)),DISP=(NEW,PASS),DCB=BUFNO=10
//CONTROL  DD  DSN=TSOUSR01.LOCKTRAC.CONTROL
//*
```

DFSKLTC0

DFSKLTC0 reads the intermediate file generated by DFSKLTB0 and creates a summary report and a detail report about the elapsed wait times for lock requests by database. The report format is determined by the presence or absence of DD statements. The default detail report created by the utility is listed in lock request completion time order. The utility also optionally creates an additional output data set containing the detail data, which can be sorted in any order.

DFSKLTC0 can:

- Format data into a readable form
- Print optional summary reports
- Print optional detailed reports
- Create an optional detail output data set

Any detected errors are displayed as a WTO. Conditions that can cause errors are:

- Unable to open a data set (for any supplied DD statement or data set)
- Bad return codes from the DSPSERV macro
- Bad return code from ALESERV macro
- Header record not found where expected on extract file

JCL Requirements for DFSKLTC0

//KLTC0 generates reports and optional output data sets.

The format of the EXEC statement is:

```
//KLTC0 EXEC PGM=DFSKLTC0
```

DD Statements for DFSKLTC0

SYSPRINT DD

Images of the control statement are written to this data set. This data set is required. The DCB parameters for this data set are RECFM=FB,LRECL=80. For example:

```
//SYSPRINT DD  SYSOUT=*
```

TRACESUM DD

Specifies summary information about the lock contention. This data set is optional. For example:

```
//TRACESUM   DD SYSOUT=*
```

EXTRACT DD

Specifies the output file passed from DFSDLTB0. This data set is required. For example:

```
//EXTRACT    DD  DSN=&EXTRACT,DISP=(OLD,DELETE)
```

DETAIL1 DD
Contains detailed wait data in lock request completion time sequence. This data set is optional. For example:

```
//DETAIL1    DD SYSOUT=*
```

DETOUT1 DD
Contains the same information as the DETAIL1 file but without headings that can be used by subsequent sort steps. This data set is optional. For example:

```
//DETOUT1    DD DSN=LCKTRACE.OUTPUT,
    //           UNIT=SYSDA,DISP=(NEW,CATLG,KEEP),
    //           SPACE=(CYL,(20,20),RLSE),
    //           DCB=(RECFM=FBA,LRECL=120,BLKSIZE=1200),
```

SYSIN DD
Contains the control statements. This data set is required. The DCB parameters for the SYSIN data set are RECFM=FB,LRECL=80. For example:

```
//SYSIN    DD  *
```

JCL Example for DFSKLTC0

The following example shows the JCL used to run DFSKLTC0.

```
//KLTC0   EXEC PGM=DFSKLTC0,REGION=4M
//STEPLIB  DD  DSN=IMS910.SDFSRESL,DISP=SHR
//SYSUDUMP DD  SYSOUT=*
//SYSPRINT DD  SYSOUT=*
//TRACESUM DD  SYSOUT=*
//EXTRACT  DD  DSN=TSOUSR01.TRACE.TEMP,DISP=(OLD,DELETE)
//DETAIL1  DD  SYSOUT=*
//DETOUT1  DD  DSN=TSOUSR01.TRACE.DETOUT,DISP=SHR
//SYSIN    DD  *
```

Control Statements for DFSKLTC0

DFSKLTC0 processing is directed by control statements that are read from the SYSIN file. Control statements are 80-byte fixed length records. All control statements are optional. The control statements are subject to the following syntactical rules:

- Keywords must begin in column 1.
- Each keyword must occur on a separate line.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement.
- Individual keywords and their associated values can not span or be continued on multiple control statements.
- Keywords must be in upper case.

Control Keywords for DFSKLTC0

INT
Indicates that internal IRLM latch waits should be included in the reports, as well as waits due to true contention.

DB=
Indicates which databases are to be included in the reports. The DB= keyword is optional. If omitted, all databases are reported. Multiple occurrences of the DB= keyword are allowed. The format of the DB= keyword is a 1- to 8-character name.

Restrictions: None

MINTIME=
Specifies the minimal wait time, expressed in milliseconds, for which reporting should occur. The MINTIME= keyword is optional. If omitted, all wait times will be reported. The format of the MINTIME= keyword is a 1- to 3-digit number.

Restrictions: None

PST=
Specifies the partition specification table (PST) or region, expressed as a decimal number, for which reporting should occur. The PST= keyword is optional. If omitted, all PSTs will be reported. Multiple occurrences of the PST= keyword are allowed. The format of the PST= keyword is a 1- to 3-digit number.

Restrictions: None

IRLM Lock Trace Analysis Summary Report

The summary report created by DFSKTLC0 is written to the file identified by the TRACESUM DD statement in the JCL. Figure 233 is an example of the IRLM Lock Trace Analysis Summary report. In the first half of the summary report, the data is presented in DMB name order. In the second half of the summary report, the data is presented in Wait Time Order.

```
         Suspended IRLM Lock Requests Summary Report - DMB Name Order  Page 001
Trace Date = 11/04/2003  Trace Start Time = 17:18:38  Trace End Time = 17:20:26
Trace Elapsed Time (secs) =     107
Trace Input DSN = IDOC.D031104.V9FPATH.LOCKTRA.IM1OLP01

   Database  DS   Lock Req     Wait  Not Int      Total    Average   Maximum
       Name  Id      Count    Count    Count       Time       Time      Time

   CUSTDB    01         21        0        0      0.000      0.000      0.00
   CUSTDB    02         19        0        0      0.000      0.000      0.00
   CUSTDB    03         26        0        0      0.000      0.000      0.00
   CUSTDB    04         49        0        0      0.000      0.000      0.00
   CUSTDB    05         18        0        0      0.000      0.000      0.00
        Suspended IRLM Lock Requests Summary Report - Wait Time Order Page 001
Trace Date = 11/04/2003  Trace Start Time = 17:18:38  Trace End Time = 17:20:26
Trace Elapsed Time (secs) =     107
Trace Input DSN = IDOC.D031104.V9FPATH.LOCKTRA.IM1OLP01

   Database  DS   Lock Req     Wait  Not Int      Total    Average   Maximum
       Name  Id      Count    Count    Count       Time       Time      Time

   FP AREA   00         83        1        1      2.192      2.192      2.19
   CUSTDB    01         21        0        0      0.000      0.000      0.00
   CUSTDB    02         19        0        0      0.000      0.000      0.00
   CUSTDB    03         26        0        0      0.000      0.000      0.00
   CUSTDB    04         49        0        0      0.000      0.000      0.00
```

Figure 233. Example IRLM Lock Trace Analysis Summary Report

IRLM Lock Trace Analysis Detail Report

The detail report created by DFSKTLC0 is written to the file identified by the DETAIL1 DD statement in the JCL. Figure 234 on page 549 shows an example of the IRLM Lock Trace Analysis Detail report.

```
                              Suspended IRLM Lock Requests Report - Req Comp Order                        Page 0001
Trace Date = 11/04/2003 DSN = IDOC.D031104.V9FPATH.LOCKTRA.IM1OLP01
Lock Request Lock Request ----Wait----- PST --Lock-- --------Resource------- Flag --IRLM--- ---------Call--------- Trace
 Start Time    End Time    Elapsed Type Num Type Lvl    DB    DS RBA/HASH S      RCFB TRAC Type Num      Time     Seq#

17:18:41.262 17:18:43.455     2.192  L  163 FPAR  6  FP AREA  C2 F8E2E3C3   KF   0000 2080                        C7CD
17:18:50.413 17:18:50.413     0.004  L  134 FPCI  8  WAREDB   04 000000C0 F K    0440 2080                        3A1C
17:20:07.202 17:20:07.202     0.004  L  134 FPCI  8  WAREDB   0C 000000F0 F K    0440 2080                        9C2A
```

Figure 234. Example IRLM Lock Trace Analysis Detail Report

Chapter 30. RECON Query of Log Data Set Names Utility (DFSKARC0)

The RECON Query of Log Data Set Names utility (DFSKARC0) analyzes the RECON data sets to find appropriate log data set names. Based on the control statements that you provide, it can determine the following information:

- Data set names for OLDS, SLDS or LOGS data sets
- The names for the primary or secondary log data sets
- The volume serial numbers for these data sets

The logs can be selected by any or all of the following parameters:

- Starting date or time
- Ending date or time
- SYSID

Information from the RECON data sets can be extracted from either of the following places:

- The RECON data sets themselves, when available on the system that executed DFSKARC0
- A pre-existing report generated by the DBRC control statements `LIST.LOG`

Although DFSKARC0 can be used to create DD statements for use with other log analysis utilities, these utilities cannot be executed in the same job. Not only must they be in different jobs, but the job containing the other utilities must not be submitted until the job containing DFSKARC0 has completed. The reason for this restrictions is related to the following two factors:

- DFSKARC0 creates JCL in the JCLPDS for the DD statements that identify the logs that other utilities access through the INCLUDE statement.
- JES (Job Entry System) expands JCL from INCLUDE or procedure statements as soon as the job has been submitted. If both DFSKARC0 and a subsequent log analysis utility are executed in the same job at the time this job is received by JES, the JCL referenced by the INCLUDE statement is expanded. However, when the job is received by JES, DFSKARC0 has not yet run, so DFSKARC0 could not have populated the JCLPDS member, and the contents of the member are not what the subsequent log analysis utility program expects DFSKARC0 to provide. If these two steps are not separated, JES will reads either:
  - An empty PDS member if this member has never been used before
  - The contents of the prior run if this PDS member is reused

DFSKARC0 can be invoked using the KBLA panel-driven interface (option 5.1) or using JCL. Figure 235 on page 552 is an example of the Select Logs From RECON panel in the KBLA panel-driven interface.

```
                                                    TIME....09:21:15
                                                    DATE....2004/06/21
Fill out the following variables and press ENTER .  JULIAN..2004.173

  COPY1 DSN. . . . . .  IMSVS.IMSTESTG.P45.IRLM.LOG
  COPY2 DSN. . . . . .
  IMS Log Version  . . . . 9

  Start Date. . . . . .          (Julian Date eg: 2002190)
  Start Time (UTC). . . . . .    (hhmmss eg: 133000)
  Stop Date . . . . . .          (Julian Date eg: 2002190)
  Stop Time (UTC) . . . . . .    (hhmmss eg: 133500)
  Output DSN Keyword. . . . . .  The Output DSN will be:
  Use Existing LIST.LOG? .   (Y/N)  USERID.keyword.KBLA
  DSN Containing LIST.LOG.
  SSIDS. *

  Number of Log DSNs
  LOGTYPE SLD (OLD/SLD/LOG)  Use Secondary Log?     Log Cataloged?  N
  UNIT. .
```

Figure 235. KBLA Select Logs From RECON Panel to Invoke DFSKARC0

The following topics provide additional information:

- "Input and Output for DFSKARC0"
- "JCL Requirements for DFSKARC0"
- "Control Statements for DFSKARC0" on page 554
- "Output Examples of DFSKARC0" on page 556
- "Return Codes for DFSKARC0" on page 557
- "RECON Query Summary Report" on page 557

Input and Output for DFSKARC0

Types of input to DFSKARC0 include:

- Control statements to direct processing (File CNTLCRDS)
- DBRC data sets (Files RECON1 AND RECON2)
- DBRC control statement (File SYSIN)

Types of output from DFSKARC0 include:

- List of selected log data sets (File DSNLIST)
- List of selected log data sets in a JCL-like format (File JCLOUT)
- Statistical summary reports (File REPORT)

Depending on the control statement parameters, the DBRC `List.Log` report read by DFSKARC0 (File SYSPRINT) can be considered input or output.

JCL Requirements for DFSKARC0

The EXEC statement to run DFSKARC0 must be in the following form:

```
//RUNRCN  EXEC  PGM=DFSKARC0
```

DD Statements

CNTLCRDS (Input)
Contains the CNTLCRDS control statements. This data set is always required. See "Control Statements for DFSKARC0" on page 554 for more information on CNTLCRDS.

The data communications block (DCB) for this data set is RECFM=FB,LRECL=80.

DSNLIST (Output)
Contains a list of the names of the selected IMS log data sets. DSNLIST can be used during the execution of KBLA Panel Option 5.2, in which case it can be copied as the input list of logs. This data set is always required.

The DCB for this data set is RECFM=FB,LRECL=80.

Related Reading: For more information on KBLA Panel Option 5.2, see "Defining the Selection of IMS Logs using Option 5" on page 507.

JCLOUT (Output)
Contains a DD statement for each of the selected IMS log data sets. This file can be used to specify the log data sets to be processed by various other log analysis utilities within KBLA. The following statements should be included in the JCL to execute the other KBLA utilities:

```
// JCLLIB ORDER=(a.b.c)
```

where *a.b.c* is the PDS referenced by the JCLOUT DD statement in DFSKARC0.

```
// INCLUDE MEMBER=(pdsmbr)
```

where *pdsmbr* is the member name referenced by the JCLOUT DD statement in DFSKARC0.

This data set is always required.

The DCB for this data set is RECFM=FB,LRECL=80.

RECON1, RECON2 (Input)
Contains the RECON data sets that are used by the DBRC function of IMS. These data sets can also be identified through dynamic allocation. In this case, the dynamic allocation libraries must be included in the STEPLIB concatenation or an equivalent method of identifying the data sets. These data sets are required if no `LIST.LOG` report is provided in the SYSPRINT DD statement.

REPORT (Output)
Contains diagnostic messages and summary reports.

The DCB for this data set is RECFM=FB,LRECL=133.

STEPLIB (Input)
Describes the library that contains KBLA load modules.

SYSIN (Input)
Contains the `LIST.LOG` statement that is used by DBRC for processing.

The DCB for this data set is RECFM=FB,LRECL=80.

SYSPRINT (Input/Output)
SYSPRINT is a data set that contains the results of a `LIST.LOG DBRC` command that can be used in two ways. If you do not use the NORECON control statement, DFSKARC0 invokes DBRC, and the results are written to SYSPRINT. If you use the NORECON control statement, you must populate the SYSPRINT file with your own LIST.LOG results. For DFSKARC0 to get read and write access to the SYSPRINT file, a data set on a DASD must be specified. This data set is required if the RECON data sets are not used or are unavailable on the system running DFSKARC0.

The DCB for this data set is RECFM=FB,LRECL=133.

JCL Example

The following example shows the JCL used to run DFSKARC0.

```
//RUNRCN  EXEC  PGM=DFSKARC0
//SYSIN    DD *
   LIST.LOG
//CNTLCRDS DD *
   LOGDD=SYSUT1
   NODDNAME
   SSID=SYS3
   LOGTYPE=PRILOG
   VOLSER
   UNIT=SYSDA
   NORECON
//REPORT   DD SYSOUT=*,
//  DCB=(LRECL=133,RECFM=FB,BLKSIZE=6118)
//SYSPRINT DD DISP=SHR.,DSN=IMSVS.RECON.SYSPRINT
//DSNLIST  DD DISP=(,PASS),DSN=&&DSNLIST,
//  UNIT=SYSDA,SPACE=(TRK,(1,1)),
//  DCB=(LRECL=80,RECFM=FB,BLKSIZE=3120)
//JCLOUT   DD DISP=SHR,DSN=USERID.KBLA.SDFSKJCL(DFSKRCNC)
//SYSUDUMP DD SYSOUT=*
```

Control Statements for DFSKARC0

DFSKARC0 processing can be influenced by control statements that are available to direct functions. Records that contain the control statements are read from the CNTLCRDS file.

Control statement records are 80 bytes in length. Most control statements are optional; the result of omitting a statement is discussed for each keyword (see “Keywords”). Comment statements can be indicated with an asterisk (*) in column one. Blank records are ignored. Control statement keywords are coded within the boundaries of columns 1 through 72, and are subject to the following syntax rules:

- Keywords can start in any column.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Multiple keywords are either:
  - Separated by one or more blanks
  - Specified on multiple control statement records
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement record.
- Individual keywords and their associated values must be in the same control statement.
- Keywords must be written in upper case letters.

Keywords

CATALOG
Indicates that the JCL generated by the utility to reference the log data sets should contain the DISP=(OLD,CATLG) parameter. The CATALOG keyword is optional. If omitted, the generated JCL contains the DISP=SHR parameter. Only one CATALOG control statement is allowed.

LOGCOUNT=
Specifies the number of log data sets that should be processed by DFSKARC0.

The format of the LOGCOUNT= keyword is a 1- to 8-digit number. The LOGCOUNT= keyword is optional. If omitted, all logs that are within the time interval specification are allowed. Only one LOGCOUNT= control statement is allowed.

LOGDD=
Specifies the DDNAME to be contained in the generated JCL identifying the selected log data sets. The format of the LOGDD= keyword is a 1- to 8-character string. The LOGDD= keyword is optional. If omitted, LOG is used as the DDNAME contained in the generated JCL. Only one LOGDD= control statement is allowed.

LOGTYPE=
Identifies the type of IMS log. The format of the LOGTYPE= keyword is one of the following:

PRILOG
The primary log recovery data sets

PRIOLD
The primary online log data sets

PRISLD
The primary system log data sets

SECLOG
The secondary log recovery data sets

SECOLD
The secondary online log data sets

SECSLD
The secondary system log data sets

The LOGTYPE= keyword is optional. If omitted, the default value is SECSLD.

MAXLOGS=
Specifies the maximum number of log data sets that can be listed by DFSKARC0. The format of the MAXLOGS= keyword is a 1– to 8– digit numeral. The MAXLOGS= keyword is optional. If omitted, the default value is 100. It is only needed if error message BTSA1011E indicates that the maximum number of log data sets has been exceeded. Only one MAXLOGS= control statement is allowed.

NODDNAME
Indicates that JCL generated by the utility to reference the log data sets should not contain the DDNAME parameter for the log data sets. This parameter is used when the generated JCL is to be concatenated at run time with a DD statement already containing a DDNAME. The NODDNAME keyword is optional. If omitted, the generated JCL contains a DDNAME. Only one NODDNAME control statement is allowed.

NORECON
Identifies that the results of a prior LIST.LOG is supplied to DFSKARC0 in the SYSPRINT DD statement and that the program will evaluate this data instead of issuing the LIST.LOG command. The NORECON keyword is optional. If it is omitted, the LIST.LOG command is issued to DBRC.

SSID=
Specifies the subsystem identifier associated with the IMS subsystem. The

format of the SSID= keyword is an 8-character value. To include all of the SSIDs contained in RECON. Code SSYD=* to retrieve them all. The SSID= keyword is required.

STOPTIME=
Specifies the time of the last log data set to be processed. An exact match of time is not required. Processing stops with the first record equal to or greater than the indicated time. The format of the STOPTIME= keyword is the 14–digit time stamp used by DBRC, for which the format is yyyydddhhmmsss. The STOPTIME= keyword is optional. If omitted, the concatenation of selected logs terminates with the last log identified in RECON.

STRTTIME=
Specifies the time of the first log data set to process. An exact match of time is not required. Processing begins with the first record equal to or greater than the indicated time. There are two formats of the STRTTIME= keyword:

- STRTTIME=<value>, where <value> is the 14-digit time stamp used by DBRC, for which the format is yyyydddhhmmsss.
- STRTTIME=LAST, in which case only the latest log is used.

Recommendation: STRTTIME=LAST can be used with the LOGCOUNT= keyword to get the latest logs, up to the LOGCOUNT value. The STRTTIME= keyword is optional. If omitted, the concatenation of selected logs begins with the first log identified in RECON.

UNIT=
Specifies a unit type to be used in the DD statements generated for the log data sets instead of the unit type associated with these data sets in RECON. The value specified by the UNIT= keyword can be either a customized or provided unit type. The UNIT= keyword is optional. If it is omitted and a unit is required by the generated DD statement, the unit indicated in RECON is used. The UNIT= keyword must be specified with the VOLSER keyword.

VOLSER
This keyword specifies that the volume serial number and unit type must be included on the DD statements that are generated for the log data sets instead of assuming that the log data sets are cataloged. The VOLSER keyword is optional. If it is omitted, the log data sets are assumed to be cataloged, and the UNIT and the VOLSER keywords are not included in the generated JCL. When you want to change UNIT=, you must specify UNIT= and VOLSER together.

Output Examples of DFSKARC0

This section includes output examples for DFSKARC0.

DSNLIST

The following is an example of the DSNLIST generated by DFSKARC0, which is written to the DSNLIST DD statement in the JCL. Two log data sets were selected from RECON.

```
IMSVS.RLDSP.IMS1.D03153.T1906417.V00
IMSVS.RLDSP.IMS1.D03153.T1910211.V00
```

JCLOUT

The following are examples of the JCLOUT generated by DFSKARC0, which is written to the JCLOUT DD statement in the JCL.

In the first example, two log data sets were selected from RECON. The first data set does not have a 'DD DISP=SHR' parameter associated with it. Because a NODDNAME control statement was included, the data sets were cataloged. No specification of unit or volume serial number is included in the output.

```
// DSN=IMSVS.RLDSP.IMS1.D03153.T1906417.V00
//         DD DISP=SHR,
// DSN=IMSVS.RLDSP.IMS1.D03153.T1910211.V00
```

In the second example, two log data sets were selected from RECON. The first data set has a 'DD DISP=SHR' parameter associated with it, which also indicates the ddname associated with this concatenation of data sets. The data sets were not cataloged. The volume serial number and unit were determined from RECON because a VOLSER control statement was included.

```
//SYSUT1   DD DISP=SHR,
// DSN=IMSVS.RLDSP.IMS1.D03153.T1906417.V00,
// VOL=SER=000000,
// UNIT=SYSDA
//         DD DISP=SHR,
// DSN=IMSVS.RLDSP.IMS1.D03153.T1910211.V00,
// UNIT=SYSDA
//         DD DISP=SHR,
```

Return Codes for DFSKARC0

Code	Meaning
0	Utility successfully completed.
4	Warning messages were issued.
8	Utility terminated before completion.

RECON Query Summary Report

The summary report created by DFSKARC0 is written to the file identified by the REPORT DD statement in the JCL. Figure 236 on page 558 is an example of the RECON query summary report. In this example:

- The IMS SSID was SYS3.
- OLDS type logs were requested.
- A STRTTIME and STOPTIME range were requested.
- There were four records read from the CNTLCRDS file.
- One SSID was requested.
- 100 records were read from the SYSPRINT file to determine the appropriate log data sets.
- The default number of log data sets (100) was the maximum number of logs allowed to be processed, based on the selection criteria for STRTTIME and STOPTIME.
- One log data set was selected for processing.
- The log selected was IMSTESTL.IMS01.OLDSP1.

```
IMS TOOL / DFSKARC0: RECON QUERY SUMMARY REPORT      PAGE:        1
DATE: 2002/180 TIME: 10:22
CNTLCRDS: SSID=SYS3
CNTLCRDS: LOGTYPE=OLDS
CNTLCRDS: STRTTIME=02179161850
CNTLCRDS: STOPTIME=02179161930
NUMBER OF CNTLCRDS RECORDS READ : 4
NUMBER OF SSIDS SUPPLIED          :       1
NUMBER OF SYSPRINT LINES READ : 100
MAX. ALLOWABLE NUMBER OF LOG DSNS : 100
NUMBER OF LOG DSNS SELECTED : 1
SELECTED LOG DSN=IMSTESTL.IMS01.OLDSP1
```

Figure 236. DFSKARC0 DD Statement Report Example

Figure 237 is another example of the RECON query summary report. In this example:

- The IMS SSID was SYS3.
- SLDS type logs were requested.
- No specific time range was selected.
- There were two records read from the CNTLCRDS file.
- One SSID was requested.
- 78 records were read from the SYSPRINT file to determine the appropriate log data sets.
- The default number of log data sets (100) was the maximum number of logs allowed to be processed, based on the selection criteria for STRTTIME and STOPTIME.
- Three log data set were selected for processing.
- The log data set names are displayed in the report.

```
 IMS TOOL / DFSKARC0: RECON QUERY SUMMARY REPORT      PAGE:        1
DATE: 2002/180 TIME: 10:22
CNTLCRDS: SSID=SYS3
CNTLCRDS: LOGTYPE=SLDS
NUMBER OF CNTLCRDS RECORDS READ : 2
NUMBER OF SSIDS SUPPLIED          :       1
NUMBER OF SYSPRINT LINES READ : 78
MAX. ALLOWABLE NUMBER OF LOG DSNS : 100
NUMBER OF LOG DSNS SELECTED : 3
SELECTED LOG DSN=IMSVS.SLDSP.SYS3.D02179.T1618169.V00
SELECTED LOG DSN=IMSVS.SLDSP.SYS3.D02179.T1618488.V00
SELECTED LOG DSN=IMSVS.SLDSP.SYS3.D02179.T1619375.V00
```

Figure 237. DFSKARC0 DD Statement Report Example 2

Chapter 31. Log Summary Utility (DFSKSUM0)

The Log Summary utility (DFSKSUM0) can create a summary of log records, a detailed report based on specific search criteria, and copies of log records that have been processed.

In an IMS DB/DC or DCCTL environment, you can create a summary of the records contained in the logs produced by the system. These records can be included in or written to an OLDS, or included in or written to an archived OLDS. The summary function includes:

- First and last Log Sequence Number (LSN) in the log
- Time stamp (UTC and local) of the first and last log record
- Total number of log records in the log data set
- List of internal traces record, system restarts, dump log record, and system checkpoint (if present)
- Number of log records present for each record type and subtype
- Statistics related to individual transactions, programs, and databases
- Checking for gaps in the log

You can specify selection criteria for processing a subset of the records rather than processing all records. You can specify processing criteria, such as a starting record LSN or time, an ending LSN or time, the number of records to skip prior to processing, or the number of records to process. In addition to the summary function, DFSKSUM0 can also create a detailed report based on log information related to selected search criteria specified by control statements. Search criteria can include:

- Program name
- Transaction ID
- Database name
- Fast Path area name
- LTERM name
- Node name
- User ID
- RBA
- DRRN
- Recovery token
- Units of work
- A character string

In addition to creating reports, DFSKSUM0 can also create a copy of the log records that have been processed. The copy can consist of the entire log or a subset of the log based on any of the processing or search criteria.

The following topics provide additional information:

• “Output Examples of DFSKSUM0” on page 567

Dynamic Search

DFSKSUM0 provides a dynamically enhanced search function based on matches to the subset of data values you provide. Given as few as one data element, the utility can return those log records where a match is found for the specified data element. It also returns records that are logically associated with the search criteria. Dynamic search logic is invoked by including the DYNSEARCH global keyword in the control statements. A global keyword is an optional keyword that influences how a utility is processed.

DFSKSUM0’s dynamic search is different than search capabilities in exit routines to DFSERA10, such as the IBM-supplied DFSERA70, which were designed to search for elements such as:

- Partition Specification Table (PST)
- Recovery token
- Units of work
- PSB name
- Transaction name

Many log records contain some, but not all of these fields. In order to match as many log records as possible when exit routines such as DFSERA70 are used, you must specify as much as possible for the search criteria. The utility then returns the records that match the search criteria. You do not need to know the location of the various data elements in the record, but you do need to know the values for all of the search criteria keys that will be combined to match log records.

Input and Output for DFSKSUM0

Types of input to DFSKSUM0 include:

- CNTLCRDS
- LOGDESC
- SYSUT1

Types of output from DFSKSUM0 include:

- DETAIL
- DSNLIST
- DYNCRDS
- DYNREPT
- LOGOUT
- REPORT
- SYSPRINT

An additional DD statement named SYSUT4 is a dummy file that it is retained for compatibility with exit routines invoked by DFSKSUM0. Include the following output DD statement in your JCL:

```
//SYSUT4 DD DUMMY
```

JCL Requirements for DFSKSUM0

The EXEC statement to run DFSKSUM0 must be in the following form:

```
//RUNRCN  EXEC  PGM=DFSKSUM0
```

DD Statements

CNTLCRDS (Input)
Contains the CNTLCRDS control statements. This data set is always required. See “Control Statements for DFSKARC0” on page 554 for more information on CNTLCRDS.

The DCB for this data set is RECFM=FB,LRECL=80.

LOGDESC (Input)
Contains entries for every log record type and record subtype found in the log data set. It is used to generate descriptive titles for each record type in the Log Summary Report. This data set is always required.

The DCB for this data set is RECFM=FB,LRECL=80

SYSUT1 (Input)
Contains the log record data to be processed. It can consist of a single log data set, or a concatenation of data sets. This data set is always required.

The DCB for this data set varies depending on the DCB that was used to create the log.

DETAIL (Output)
Contains images of the log records that match search criteria provided in CNTLCRDS. The DCB for this data set varies and must match the DCB associated with the SYSUT1 DD statement. This data set is optional. It is required when the DETAIL global keyword control statement has been provided in CNTLCRDS.

Note: This data set can become quite large depending on the size of the SYSUT1 input data set and the number of records that matched the search criteria.

DYNCRDS (Output)
Contains control statements matching search criteria that are dynamically generated when the DYNSEARCH global keyword control statement is provided in CNTLCRDS. These statements can be copied from this file to be used as CNTLCRDS search keywords in subsequent iterations of the utility. This data set is optional. It is required when the DYNSEARCH control statement has been provided in CNTLCRDS.

The DCB for this data set is RECFM=FB,LRECL=80.

DYNREPT (Output)
Contains the log record selection flow report, which is generated when the DYNSEARCH global keyword control statement is provided in CNTLCRDS. This data set is optional. It is required when the DYNSEARCH global keyword control statement has been provided in CNTLCRDS. See “Logical Record Selection Flow Report Example” on page 571 for an example of this report.

The DCB for this data set is RECFM=FB,LRECL=133.

LOGOUT
Contains images of the log records that have been processed by the utility. The DCB for this data set varies and must match the DCB associated with the

SYSUT1 DD statement. This data set is optional. It is required when the LOGOUT global keyword control statement has been provided in CNTLCRDS.

Note: This data set can become quite large depending on the size of the SYSUT1 input data set and the number of records that matched the search criteria.

REPORT (Output)
This file contains diagnostic messages and the summary report created by the utility. See "Log Summary Report Example" on page 567 for an example of this report. This data set is required.

The DCB for this data set is RECFM=FB,LRECL=133.

SYSPRINT (Output)
Contains the formatted output based upon the search keyword control statements provided in CNTLCRDS. This data set is required.

The DCB for this data set is RECFM=FB,LRECL=133.

JCL Example

The following example shows the JCL used to run DFSKSUM0.

```
//RUNSUM  EXEC  PGM=DFSKSUM0
//SYSUT1   DD DISP=SHR,
// DCB=BUFNO=10,
// DSN=USERID.KBLA67FA.LOG
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=133,RECFM=FBA)
//REPORT   DD DISP=SHR,
//         DSN=USERID.T6701.KBLA.R.X03252.Y141406
//LOGDESC  DD DISP=SHR,DSN=*.RUNLGD.LOGDOUT
//LOGOUT   DD DISP=(NEW,CATLG),
//  DSN=USERID.T6701.KBLA.L.X03252.Y141406,
//  UNIT=SYSDA,
//  SPACE=(CYL,(10,5),RLSE),
//  DCB=(RECFM=VB,LRECL=32756,BLKSIZE=32760)
//DETAIL   DD DISP=(NEW,CATLG),
//  DSN=USERID.KBLA.D.X03266.Y141550,
//  UNIT=SYSDA,
//  SPACE=(CYL,(10,5),RLSE),
//  DCB=(RECFM=VB,LRECL=32756,BLKSIZE=32760)
//DYNCRDS  DD DISP=(NEW,CATLG),
//  DSN=USERID.KBLA.Y.X03266.Y141550,
//  UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//  DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//DYNREPT  DD DISP=(NEW,CATLG),
//  DSN=USERID.KBLA.O.X03266.Y141550,
//  UNIT=SYSDA,SPACE=(CYL,(1,1),RLSE),
//  DCB=(RECFM=FBA,LRECL=133,BLKSIZE=6118)
//CNTLCRDS DD *
/SYSUDUMP  DD SYSOUT=*
//SYSUT4   DD DUMMY
```

Control Statements for DFSKSUM0

DFSKSUM0 processing can be influenced by control statements that are available to direct functions. The image of each record containing control statements is written to the file identified by the SYSOUT DD statement. Records that contain the control statements are read from the CNTLCRDS file.

Control statement records are 80 bytes in length. Most control statements are optional. The result of omitting a statement omission is discussed for each keyword. Comment statements can be indicated with an asterisk (*) in column one. Blank

records are ignored. Control statements keywords are coded within the boundaries of columns 1 through 72, and are subject to the following syntax rules:

- Keywords can start in any column.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Multiple keywords must be specified on separate control statement records.
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement record.
- Individual keywords and their associated values must be in the same control statement.
- Keywords must be in upper case.

Control Keywords for DFSKSUM0

Control keywords are divided into one of the following categories:

- Keywords that indicate global actions
- Keywords that indicate processing options
- Keywords that indicate search keys

Global Keywords

Global keywords are optional keywords that influence how a utility is processed. If they are omitted, the action driven by the global keyword is not performed.

Global keywords include:

DYNSEARCH
Indicates that the current invocation of DFSKSUM0 is dynamically enhancing the search for matching log records. See “Dynamic Search” on page 560 for more information about this type of processing.

LOGOUT
Indicates that all log records that are being processed should be written to the LOGOUT file.

NOWRAP
Describes how the log sequence numbers (LSN) contained on a log record are incremented with each subsequent record. However, the LSN of a log record can be lower than the LSN of the previous record. Examples of when this might occur include:

- When multiple logs have been concatenated out of sequence
- When the active OLDS data set is being processed and does not contain an end-of-file mark

In such cases, DFSKSUM0 generates a warning message in the REPORT file indicating that an LSN out-of-sequence condition has been encountered.

If NOWRAP was not specified, the utility continues processing until the end-of-file has been reached. If NOWRAP has been specified, the utility terminates processing upon detecting this condition.

SEQCHECK
Describes how the log sequence numbers (LSN) and store-clock time (STCK) contained on a log record are incremented with each subsequent record. However, a gap in the sequence of these values between records sometimes occurs. An example of when this might occur is when multiple logs have been concatenated, but a log in the sequence is missing.

If SEQCHECK was not specified, the utility continues processing until the end of the file is reached without any additional reporting. If SEQCHECK was specified, each time an out-of-sequence condition is encountered, the utility reports the following in the REPORT:

- LSN of the out of sequence record and of the prior record
- Time stamp of the out of sequence record and the prior record
- Time difference between the two records

SUMONLY
Indicates that a short version of the summary report will be generated.

Processing Keywords

Processing keywords are optional keywords that indicate how much of the log is to be processed. If they are omitted, the entire log is processed.

Restrictions:

- LOG02STA=, STARTLSN=, STARTSTCK=, SKIP= and TOKENBND are all mutually exclusive.
- LOG02STO=, STOPLSN=, STOPSTCK=, PROCESS= and TOKENBND are all mutually exclusive.

Processing keywords include:

FORMAT=
Specifies the type of record formatting that is to be generated as a result of a search keyword match. The FORMAT= keyword is optional. If omitted, the default formatting routine used is K.

Values of the FORMAT= keyword are:

B The KBLA Basic Record Formatting and Print Module (DFSKBLA3) formats the output. See “KBLA Basic Record Formatting and Print Module (DFSKBLA3)” on page 511 for an example.

S The KBLA Summary Record Formatting Module (DFSKBLA8) formats the output. See “KBLA Summary Record Formatting Module (DFSKBLA8)” on page 516 for an example.

K The Knowledge-Based Record Formatting Module (DFSKBLA9) formats the output. See “KBLA Knowledge-Based Record Formatting Module (DFSKBLA9)” on page 518 for an example.

LOG02STA=
Specifies a character string that was entered on the subject IMS subsystem with the /LOG command at the beginning of an event that was to be captured on the log. The utility begins processing after a X'02' log record that contains this character string is encountered. The LOG02STA= keyword is optional. If omitted, processing starts at the beginning of the log. The format of the LOG02STA= keyword is a 60-byte character string.

LOG02STO=
Specifies a character string that was entered on the subject IMS subsystem with the /LOG command at the end of an event that was to be captured on the log. The utility terminates processing after a X'02' log record which contains this character string is encountered. The LOG02STA= keyword is optional. If omitted, all records will be processed. The format of the LOG02STO= keyword is a 60-byte character string.

PROCESS=
Specifies the number of log records that should be processed prior to utility termination. The PROCESS= keyword is optional. If omitted, all records are processed. The format of the PROCESS= keyword is a 1- to 8-digit numeral.

SKIP=
Specifies the number of log records that should be skipped before any records are to be processed and included in reports. The SKIP= keyword is optional. If omitted, no records are skipped prior to processing. The format of the SKIP= keyword is a 1- to 8-digit number.

STARTLSN=
Specifies the LSN of the first log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated LSN. If omitted, processing starts at the beginning of the log. The format of the STARTLSN= keyword is an 8-character hexadecimal value.

STARTSTCK=
Specifies the time of the first log data set to be processed. An exact match of time is not required; processing begins with the first record equal to or greater than the indicated time. The STARTSTCK= keyword is optional. If omitted, processing starts at the beginning of the log. The format of the STARTSTCK= keyword is the 14-digit timestamp used by DBRC, for which the format is yyyydddhhmmsss.

STOPLSN=
Specifies the LSN of the last log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated time. If omitted, processing continues until the end of the log. The format of the STOPLSN= keyword is an 8-character hexadecimal value.

STOPSTCK=
Specifies the time of the last log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated time. The STOPSTCK= keyword is optional. If omitted, processing continues until end of log. The format of the STOPSTCK= keyword is the 14-digit timestamp used by DBRC, for which the format is yyyydddhhmmsss.

TOKENBND
Specifies that all records are to be skipped for processing until the X'08' record associated with a recovery token supplied with the TOKEN= keyword is encountered. It also specifies that processing should terminate after the corresponding X'07' record for this recovery token is encountered.

Search Keywords

Search keywords are optional keywords that are used as keys to locate records that are to be reported in detail. If they are omitted, no records are reported in detail. If multiple search keywords are selected, the log records that match any of the keywords are reported.

Search keywords include:

AREA=
Log records containing an area name that matches this keyword value are selected for processing. The format of the AREA= keyword is an 8-character value. The AREA= keyword is optional.

DBD=
Log records containing a DBD name that matches this keyword value are selected for processing. The format of the DBD= keyword is an 8-character value. The DBD= keyword is optional.

DRRN=
Log records containing a DRRN that matches this keyword value are selected for processing. A DRRN is a hexadecimal 4 character field. The DRRN= keyword represents a character representation of the hexadecimal value. The format of the DRRN= keyword is an 8-character value. The DRRN= keyword is optional.

LTERM=
Log records containing an LTERM name that matches this keyword value are selected for processing. The format of the LTERM= keyword is an 8-character value. The LTERM= keyword is optional.

NODE=
Log records containing a node name that matches this keyword value are selected for processing. The format of the NODE= keyword is an 8-character value. The NODE= keyword is optional.

PGM=
Log records containing a program that matches this keyword value are selected for processing. The PGM= and PSB= parameters are used interchangeably by the utility. The format of the PGM= keyword is an 8-character value. The PGM= keyword is optional.

PSB=
Log records containing a PSB that matches this keyword value are selected for processing. The PGM= and PSB= parameters are used interchangeably by the utility. The format of the PSB= keyword is an 8-character value. The PSB= keyword is optional.

RBA=
Log records containing a relative block address (RBA) that matches this keyword value are selected for processing. Although an RBA is a hexadecimal 4-character field, the RBA= keyword is an 8-character representation of the hexadecimal value. The RBA= keyword is optional.

SCAN=
Log records containing a character string that matches this keyword value are selected for processing. The format of the SCAN= keyword is up to a 60-character value. If the value supplied is less than 60 characters, the value is compared for the length supplied. The SCAN= keyword is optional.

SNAPREC
Indicates that snap log records (X'67FD') and pseudo-abend log records (X'67FF') are selected for processing.

TOKEN=
Log records containing a recovery token that matches this keyword value are selected for processing. Although recovery token is a hexadecimal 16-character field, the TOKEN= keyword is a 32-character representation of the hexadecimal value. If the value supplied is less than 32 characters, the token value is compared with the left-justified token contained in the log records for the length supplied. The TOKEN= keyword is optional.

Restrictions: The TOKEN= value must be an even number of characters.

TRX=
Log records containing a transaction that matches this keyword value are selected for processing. The format of the TRX= keyword is an 8-character value. The TRX= keyword is optional.

USERID=
Log records containing a user ID that matches this keyword value are selected for processing. The format of the USERID= keyword is an 8-character value. The USERID= keyword is optional.

UOW=
Log records containing a unit of work (UOW) that matches this keyword value are selected for processing. Although UOW is a hexadecimal 34 character field, the UOW= keyword is a 68-character representation of the hexadecimal value. If the value supplied is less than 68 characters, the UOW value is compared with the left-justified UOW contained in the log records for the length supplied. The UOW= keyword is optional.

Restrictions: The UOW= value must be an even number of characters.

Return Codes for DFSKSUM0

Code	Meaning
0	Utility successfully completed.
4	Warning messages were issued.
8	Utility terminated before completion.

Output Examples of DFSKSUM0

This section includes report examples for DFSKSUM0.

Log Summary Report Example

The summary report created by DFSKSUM0 is written to the file identified by the REPORT DD statement in the JCL. This shows the DFSKSUM0 summary report.

In this example:

- The log contained three accounting records (X'06').
- A control statement that contains keyword PGM=BMP255 was supplied as search criteria.
- Two log data sets were processed.
- The IMSID for this system is SYS3.
- The log contained records with log sequence numbers (LSN) 00000001 - 00000566. Although the LSN is actually an 8 byte field, only the last 4 bytes are presented with KBLA. Processing of the log records began at the start of the log.
- The elapsed time represented in this log is displayed.
- 1382 records were read from the log.
- 61 records matched the search criteria; data from these log records is written to SYSPRINT.
- The presence of various diagnostic and trace records is indicated.
- Message queueing statistics are presented.
- External interface DB2 communicates with this subsystem.
- Database open/close records are contained on this log.

Output Examples

- System checkpoint statistics are present in the log.
- System configuration statistics are present in the log and are presented in the report.
- This system is an IMS Version 9 DB/DC system.
- Record counts and a brief description are included for each log record type. Where applicable, the records are broken down by subcode.
- Database DBOVLFPC was opened and closed.
- Database updates were logged for three databases.
- Records indicated activity with two PSBs.

```
* ********************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        1  *
* ********************************************************************************
*                                                                                *
* ACCOUNTING RECORD AT LSN: 00000002 : IMS/VS STARTED                            *
* ACCOUNTING RECORD AT LSN: 00000437 : FEOV ON SYSTEM LOG                        *
* ACCOUNTING RECORD AT LSN: 00000565 : FEOV ON SYSTEM LOG                        *
*                                                                                *
* CNTLCRDS:  PGM=BMP255                                                          *
*                                                                                *
* ********************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        2  *
* ********************************************************************************
*                                                                                *
* INPUT LOG DATA SET NAME(S)                                                     *
* IMSVS.SLDSP.SYS3.D02347.T0924053.V00                                           *
* IMSVS.SLDSP.SYS3.D02347.T0924454.V00                                           *
*                                                                                *
* ********************************************************************************
* LOG INFORMATION SUMMARY FOR IMSID: SYS3                                        *
*                                                                                *
* FIRST LSN: 00000001      LAST LSN: 00000566                                    *
* FIRST SELECTED LSN: 00000001                                                   *
*                                                                                *
* FIRST LOG RECORD STCK   (UTC): 2002347 1724059     (LOCAL): 2002347 0924059    *
* LAST LOG RECORD STCK    (UTC): 2002348 0049537     (LOCAL): 2002347 1649537    *
* FIRST SELECTED LOG STCK (UTC): 2002347 1724059     (LOCAL): 2002347 0924059    *
* DIFFERENCE BETWEEN UTC AND LOCAL TIME (HHMM): -0800                            *
* ELAPSED TIME ON SELECTED LOG(S):                              000 07:25:47.8   *
*                                                                                *
*                                                                                *
* TOTAL # OF LOG RECORDS READ AND PROCESSED     :     1382                       *
*                                                                                *
* # OF LOG RECORDS WRITTEN TO SYSPRINT FILE     :       61                       *
*                                                                                *
* IMS START LOG RECORDS DETECTED   (X'06')      : YES                            *
* TRACE LOG RECORDS DETECTED     (X'6701')      : NO                             *
* SYS. DIAGNOSTIC RECS. DETECTED (X'67D0')      : YES                            *
* TRACE TABLE LOG RECORDS DETECTED (X'67FA')    : NO                             *
* SNAP DUMP LOG RECORDS DETECTED (X'67FD')      : NO                             *
* PSEUDO ABEND RECORDS DETECTED  (X'67FF')      : NO                             *
* # OF PGM ABENDS (X'67FF' PSEUDO ABEND RECORDS):        0                       *
* # OF DEADLOCKS  (X'67FF' DEADLOCK RECORDS    ):        0                       *
*                                                                                *
* TOTAL # OF QUEUED RECORDS                     :        1                       *
* INPUT MESSAGES QUEUED TO MSC                  :        0                       *
* INPUT MESSAGES QUEUED NON-MSC                 :        1                       *
* INPUT MESSAGES QUEUED TO SYNC APPC            :        0                       *
* INPUT MESSAGES QUEUED TO ASYNC APPC           :        0                       *
* INPUT MESSAGES QUEUED TO SYNC OTMA            :        0                       *
* INPUT MESSAGES QUEUED TO ASYNC OTMA           :        0                       *
* IMS PARTNERS DETECTED                         : NO                             *
* EXTERNAL INTERFACES DETECTED                  : YES                            *
*     DB2A                                                                       *
```

```
* DB OPEN/CLOSE LOG RECS DETECTED (X'20/21')    : YES                          *
* SYSTEM CHKPT LOG RECORDS DETECTED (X'4001')   : YES                          *
* SYSTEM CONFIGURATION STATS AVAILABLE (X'45FF'): YES                          *
* STATISTICS BEGIN RECORD AVAILABLE    (X'4500' : YES                          *
* LOGGER STATISTICS RECORD AVAILABLE   (X'4507) : YES                          *

*                                                                              *

* ******************************************************************************
*          IMS SYSTEM CONFIGURATION                                            *
*                                                                              *
* REGION TYPE: ONLINE DB/DC                                                    *
* IMS LEVEL  :  910                                                            *
*                                                                              *
* APPC=N SPECIFIED                                                             *
* ETO=Y  SPECIFIED                                                             *
* HSB=N  SPECIFIED                                                             *
* LSO=S SPECIFIED                                                              *
* SYSTEM IS NOT XRF CAPABLE                                                    *
* ******************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        3  *
* ******************************************************************************
*                                                                              *
* SYSTEM IS NOT RSR CAPABLE                                                    *
* SYSTEM IS NOT USING SHARED QUEUES                                            *
* XRF NOT IN SYNCH                                                             *
*                                                                              *
* OS NAME   : ECDVL89                                                          *
* OS PRODUCT: z/OS                                                             *
* OS VERSION: 010400                                                           *
* OLDS BLOCK SIZE      :    22528                                              *
* NUMBER OF LOG BUFFERS:        5                                              *
* WADS TRACK GROUPS    :        1                                              *
* WADS TRACKS/CYL      :       15                                              *
* BLOCKS/WADS TRACK    :       18                                              *
* BYTES/WADS TRACK     :    36864                                              *
* ******************************************************************************
* ******************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        4  *
* ******************************************************************************
*                                                                              *
*          LOG RECORD OCCURRENCES STATISTICS                                   *
*                                                                              *
* OCCURRENCES OF RECORD TYPE 01:        1      INPUT MESSAGE QUEUED             *
* OCCURRENCES OF RECORD TYPE 02:        2      RECOVERABLE COMMAND ENTERED      *
* OCCURRENCES OF RECORD TYPE 03:       47      OUTPUT MESSAGE QUEUED            *
* OCCURRENCES OF RECORD TYPE 04:        1      TRACKING SITE INFORMATION        *
* OCCURRENCES OF RECORD TYPE 06:        3      IMS RESTART RELATED RECORD       *
* OCCURRENCES OF RECORD TYPE 07:        3      APPLICATION PGM TERMINATED       *
* OCCURRENCES OF RECORD TYPE 08:        3      APPLICATION PGM SCHEDULED        *
* OCCURRENCES OF RECORD TYPE 20:        1      DATABASE WAS OPENED              *
* OCCURRENCES OF RECORD TYPE 21:        1      DATABASE WAS CLOSED              *
* OCCURRENCES OF RECORD TYPE 31:       48      GET UNIQUE (GU) ISSUED FOR MSG   *
* OCCURRENCES OF RECORD TYPE 33:       47      QMGR RELEASED A DDRN             *
* OCCURRENCES OF RECORD TYPE 35:       48      MSG WAS ENQUEUED/RE-ENQUEUED     *
* OCCURRENCES OF RECORD TYPE 36:       47      THIS MESSAGE WAS DEQ/SAVED/DEL   *
* OCCURRENCES OF RECORD TYPE 37:        7      SYNCPOINT PROCESSOR LOG RECORD   *
*   OCCURRENCES OF SUBCODE 3730:        7      SYNCPOINT PROCESSOR LOG RECORD   *
* OCCURRENCES OF RECORD TYPE 40:      351      TOTAL NUMBER OF CHECKPOINT REC   *
*   OCCURRENCES OF SUBCODE 400F:        2      MESSAGE QUEUE TTR / LCD FOLLOW   *
*   OCCURRENCES OF SUBCODE 4001:        2      CHECKPOINT PROCESS START         *
*   OCCURRENCES OF SUBCODE 4003:       60      CNT AND/OR LNB CHKPT RECORDS     *
*   OCCURRENCES OF SUBCODE 4004:       44      SMB(S) FOLLOW                    *
*   OCCURRENCES OF SUBCODE 4005:       16      NON-VTAM CTB(S) FOLLOW           *
*   OCCURRENCES OF SUBCODE 4006:       26      DMB(S) FOLLOW                    *
*   OCCURRENCES OF SUBCODE 4007:       14      PSB FOLLOWS                      *
*   OCCURRENCES OF SUBCODE 4008:        2      NON-VTAM CLB AND/OR LLB FOLLOW   *
```

```
*   OCCURRENCES OF SUBCODE 4010:        2      NON-VTAM CRB(S) FOLLOW            *
*   OCCURRENCES OF SUBCODE 4014:        8      SPQB(S) FOLLOW                    *
*   OCCURRENCES OF SUBCODE 4021:       78      VTAM VTCB(S) FOLLOW               *
*   OCCURRENCES OF SUBCODE 4022:        2      QAB/CNT DATA FIELDS CHECKPOINT    *
*   OCCURRENCES OF SUBCODE 4031:        2      SIDX FOLLOW                       *
*   OCCURRENCES OF SUBCODE 4033:        2      TSCD, MTES AND MCBS FOLLOWS       *
*   OCCURRENCES OF SUBCODE 4080:        2      FASTPATH CHKPT INFO BEGIN HERE    *
*   OCCURRENCES OF SUBCODE 4083:        2      RCTE FOLLOWS                      *
*   OCCURRENCES OF SUBCODE 4084:       82      DMCB AND DMAC FOLLOW              *
*   OCCURRENCES OF SUBCODE 4087:        1      ADSC FOLLOWS                      *
*   OCCURRENCES OF SUBCODE 4089:        2      FASTPATH CHKPT INFO END HERE      *
*   OCCURRENCES OF SUBCODE 4098:        2      CHKPT INFORMATION ENDS HERE       *
* OCCURRENCES OF RECORD TYPE 41:        6      BATCH OR BMP ISSUED A CHKP        *
* OCCURRENCES OF RECORD TYPE 42:        4      OLDS SWITCH/CHKPT WAS TAKEN       *
* OCCURRENCES OF RECORD TYPE 43:        6      STATUS OF CURRENT OLDS D/S        *
* OCCURRENCES OF RECORD TYPE 45:       62      BEGIN-STATISTICS RECORD           *
*   OCCURRENCES OF SUBCODE 45FF:        2      END OF STATISTICS RECORD          *
*   OCCURRENCES OF SUBCODE 450A:        2      LATCH MANAGEMENT STATISTICS       *
*   OCCURRENCES OF SUBCODE 450B:        2      SELECTIVE DISPATCHER STATS        *
*   OCCURRENCES OF SUBCODE 450C:        2      STORAGE POOL STATISTICS           *
*   OCCURRENCES OF SUBCODE 450D:        2      RECEIVE ANY BUFFERS STATISTICS    *
*   OCCURRENCES OF SUBCODE 450E:       14      FIXED STORAGE POOL STATISTICS     *
*   OCCURRENCES OF SUBCODE 450F:        2      DISPATCHER STATISTICS             *
*   OCCURRENCES OF SUBCODE 4500:        2      BEGIN-STATISTICS RECORD           *
*   OCCURRENCES OF SUBCODE 4502:        2      QUEUE BUFFER STATISTICS           *
* ********************************************************************************
*  IMS TOOL / DFSKSUM             DATE: 2003/102   TIME: 06:08   PAGE:        5  *
* ********************************************************************************
*                                                                                *
*   OCCURRENCES OF SUBCODE 4503:        2      FORMAT POOL STATISTICS            *
*   OCCURRENCES OF SUBCODE 4504:        8      DL/I BUFFER POOL STATISTICS       *
*   OCCURRENCES OF SUBCODE 4505:        2      VARIABLE STORAGE POOL STATS       *
*   OCCURRENCES OF SUBCODE 4506:        2      APPLICATION SCHEDULING STATS      *
*   OCCURRENCES OF SUBCODE 4507:        2      LOGGING STATISTICS                *
*   OCCURRENCES OF SUBCODE 4508:        8      VSAM BUFFER POOL STATISTICS       *
*   OCCURRENCES OF SUBCODE 4509:        2      PROGRAM ISOLATION STATISTICS      *
*   OCCURRENCES OF SUBCODE 4510:        2      RCF MULTI-TCB STATISTICS          *
*   OCCURRENCES OF SUBCODE 4521:        2      IRLM SUBSYSTEM STATISTICS         *
*   OCCURRENCES OF SUBCODE 4522:        2      IRLM SYSTEM STATISTICS            *
* OCCURRENCES OF RECORD TYPE 47:        2      CHKPT JUST TAKEN.PST(S) LISTED    *
* OCCURRENCES OF RECORD TYPE 48:       56      OLDS PADDING RECORD               *
* OCCURRENCES OF RECORD TYPE 4C:       19      A BACKOUT FOR TOKEN WAS DONE      *
* OCCURRENCES OF RECORD TYPE 50:      427      DB UPDATE RECORD                  *
*   OCCURRENCES OF SUBCODE 5050:      427      RECOVERY/BACKOUT DATA             *
* OCCURRENCES OF RECORD TYPE 56:       56      EXT SUBSYSTEM SUPPORT RECOVERY    *
*   OCCURRENCES OF SUBCODE 5607:       28      START OF A UNIT-OF-RECOVERY       *
*   OCCURRENCES OF SUBCODE 5612:       28      PHASE 2 SYNCPOINT END             *
* OCCURRENCES OF RECORD TYPE 57:        6      BEGIN DB UPDATE IN RSR ENVIRON    *
*   OCCURRENCES OF SUBCODE 5701:        4      BEGIN DB UPDATE IN RSR ENVIRON    *
*   OCCURRENCES OF SUBCODE 5703:        2      END DB UPDATE IN RSR ENVIRON      *
* OCCURRENCES OF RECORD TYPE 59:      122      FP INPUT MESSAGE RECEIVED         *
*   OCCURRENCES OF SUBCODE 59FF:        3      FP MISCELLANEOUS INTERNAL INFO    *
*   OCCURRENCES OF SUBCODE 5921:        3      DEDB AREA D/S WAS OPENED          *
*   OCCURRENCES OF SUBCODE 5922:        1      DEDB AREA D/S WAS CLOSED          *
*   OCCURRENCES OF SUBCODE 5923:        1      DEDB AREA D/S STATUS CHANGED      *
*   OCCURRENCES OF SUBCODE 5937:       19      SYNCPOINT OPERATION COMPLETED     *
*   OCCURRENCES OF SUBCODE 5950:       90      DEDB UPDATED                      *
*   OCCURRENCES OF SUBCODE 5957:        5      LOCAL/GLOBAL PORTION OF DMAC      *
* OCCURRENCES OF RECORD TYPE 67:        6      SYSTEM DIAGNOSTIC LOG RECORD      *
*   OCCURRENCES OF SUBCODE 67D0:        6      DIAGNOSTIC TRACE RECORD           *
* ********************************************************************************
* ********************************************************************************
*  IMS TOOL / DFSKSUM             DATE: 2003/102   TIME: 06:08   PAGE:        6  *
* ********************************************************************************
*                                                                                *
*  DATABASE OPEN / CLOSE STATISTICS (FROM X'20' AND '21' RECORDS)                *
*                                                                                *
```

```
* DATABASE DBOVLFPC: # OF TIMES OPENED :        1                              *
* DATABASE DBOVLFPC: # OF TIMES CLOSED :        1                              *
* ******************************************************************************


* ******************************************************************************
*  IMS TOOL / DFSKSUM             DATE: 2003/102   TIME: 06:08   PAGE:        7  *
* ******************************************************************************
*                                                                                *
*  DATABASE LOG RECORDS STATISTICS (FROM X'50' AND '59' RECORDS)                 *
*                                                                                *
* DATABASE DBOVLFPC: # OF DB UPDATE RECORDS      427                             *
* DATABASE DEDBDD01: # OF DB UPDATE RECORDS       25                             *
* DATABASE DEDBJN22: # OF DB UPDATE RECORDS       70                             *
* ******************************************************************************
* ******************************************************************************
*  IMS TOOL / DFSKSUM             DATE: 2003/102   TIME: 06:08   PAGE:        8  *
* ******************************************************************************
*                                                                                *
*  PROGRAM LOG RECORDS STATISTICS (FROM X'07' RECORDS)                           *
*                                                                                *
* PROGRAM BMP255   TRANSACTION:            OCCURRED:       2                     *
* PROGRAM PSBCOMPT TRANSACTION:            OCCURRED:       1                     *
* ******************************************************************************
* ******************************************************************************
*  IMS TOOL / DFSKSUM             DATE: 2003/102   TIME: 06:08   PAGE:        9  *
* ******************************************************************************
*                                                                                *
*  PGM/TRAN LOG RECORDS STATISTICS (FROM X'08' RECORDS)                          *
*                                                                                *
* PGM/TRAN: BMP255   OCCURRED:       2                                           *
* PGM/TRAN: PSBCOMPT OCCURRED:       1                                           *
* ******************************************************************************
*          END OF IMS LOG SUMMARY REPORT                                         *
* ******************************************************************************
```

Logical Record Selection Flow Report Example

The logical record selection report is produced by DFSKSUM0 when search criteria is invoked from KBLA 4.1 and a value of `Y` is entered in **Create Dynamic Search Keys?** field.

The report consists of the following columns:

LC	2-character hexadecimal log code
LSN	8-character hexadecimal line sequence number
Reason	Explanation for why this particular log record was selected
PST	Decimal representation of the PST
HEXPST	4-character hexadecimal representation of the PST
Data	Data that triggered a match for this log record

Figure 238 on page 572 is an example of the DFSKSUM0 logical record selection flow report. In this example, a search was requested for Transaction TRN11301. Log records that contained a matching value for this transaction are identified with 'TRAN MATCHED CNTLCRDS'. Records that were selected because they matched the PST, Recovery Token, or UOW associated with this transaction are included in the list, and the applicable reason for the match is indicated.

Output Examples

```
1 IMS TOOL / DFSKSUM LOG RECORD SELECTION FLOW   DATE: 2003/102   TIME: 06:08   PAGE:        1
LC LSN      REASON                    PST   HEXPST  DATA
01 7EE9CF42 TRAN MATCHED CNTLCRDS     0     0000    TRN11301
01 7EE9CF42   UOW FOR TRAN            0     0000    C9D4E2C540404040B730664391761705C9D4E2C540404040B730664391761705000O
35 7EE9CF43 TRAN MATCHED CNTLCRDS     0     0000    TRN11301
35 7EE9CF43   TOKEN FOR 35            0     0000    00000000000000000000000000000000
35 7EE9CF43   UOW FOR 35              0     0000    C9D4E2C540404040B730664391761705C9D4E2C540404040B730664391761705000O
08 7EE9CF46 TRAN MATCHED CNTLCRDS     348   015C    TRN11301
08 7EE9CF46   TOKEN FOR 08            348   015C    C9D4E2C540404040014CBA2000000000
56 7EE9CF47 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
56 7EE9CF47 PST MATCH                 348   015C    348
56 7EE9CF47   PGM FOR 56              348   015C    PGMZ1113
31 7EE9CF48 TRAN MATCHED CNTLCRDS     348   015C    TRN11301
31 7EE9CF48   TOKEN FOR 31            348   015C    C9D4E2C540404040014CBA2000000000
31 7EE9CF48   UOW FOR 31              348   015C    C9D4E2C540404040B730664391761705C9D4E2C540404040B730664391761705000O
56 7EE9D049 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
56 7EE9D049 PST MATCH                 348   015C    348
56 7EE9D049   PGM FOR 56              348   015C
56 7EE9D04A TOKEN MATCH               0     0000    C9D4E2C540404040014CBA2000000000
56 7EE9D04A   PGM FOR 56              0     0000
56 7EE9D0E9 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
56 7EE9D0E9 PST MATCH                 348   015C    348
56 7EE9D0E9   PGM FOR 56              348   015C
35 7EE9D103 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
35 7EE9D103 PST MATCH                 348   015C    348
35 7EE9D103   TOKEN FOR 35            348   015C    C9D4E2C540404040014CBA2000000000
35 7EE9D103   UOW FOR 35              348   015C    C9D4E2C540404040B730664391761705C9D4E2C540404040B73066439E600DC30000
59 7EE9D104 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
59 7EE9D104 PST MATCH                 348   015C    348
59 7EE9D104 PSB MATCH                 348   015C    PGMZ1113
59 7EE9D105 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
59 7EE9D105 PST MATCH                 348   015C    348
59 7EE9D105 PSB MATCH                 348   015C    PGMZ1113
37 7EE9D106 PST MATCH                 348   015C    348
59 7EE9D107 TRAN MATCHED CNTLCRDS     0     0000    TRN11301
59 7EE9D107   PGM FOR 59              0     0000
37 7EE9D108 TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
37 7EE9D108 PST MATCH                 348   015C    348
31 7EE9D10A UOW MATCH                 768   0300    C9D4E2C540404040B730664391761705C9D4E2C540404040B73066439E600DC30000
31 7EE9D10A   TOKEN FOR 31            768   0300    00000000000000000000000000000000
31 7EE9D10A   UOW FOR 31              768   0300    C9D4E2C540404040B730664391761705C9D4E2C540404040B73066439E600DC30000
56 7EE9D10E TOKEN MATCH               348   015C    C9D4E2C540404040014CBA2000000000
56 7EE9D10E PST MATCH                 348   015C    348
56 7EE9D10E   PGM FOR 56              348   015C
56 7EE9D10F PST MATCH                 348   015C    348
56 7EE9D10F PSB MATCH                 348   015C    PGMZ1113
56 7EE9D115 PSB MATCH                 0     0000    PGMZ1113
31 7EE9D126 PST MATCH                 768   0300    768
31 7EE9D126   TOKEN FOR 31            768   0300    00000000000000000000000000000000
31 7EE9D126   UOW FOR 31              768   0300    C9D4E2C540404040B73066439F575742C9D4E2C540404040B73066439F5757420000
36 7EE9D163 UOW MATCH                 0     0000    C9D4E2C540404040B73066439F575742C9D4E2C540404040B73066439F5757420000
33 7EE9D164 UOW MATCH                 0     0000    C9D4E2C540404040B73066439F575742C9D4E2C540404040B73066439F5757420000
1 IMS TOOL / DFSKSUM LOG RECORD SELECTION FLOW  DATE: 2003/102   TIME: 06:08   PAGE:        2
LC LSN      REASON                    PST   HEXPST  DATA
31 7EE9D165 PST MATCH                 768   0300    768
31 7EE9D165   TOKEN FOR 31            768   0300    00000000000000000000000000000000
31 7EE9D165   UOW FOR 31              768   0300    C9D4E2C540404040B7306643A1ED9781C9D4E2C540404040B7306643A1ED97810000
36 7EE9D1C3 UOW MATCH                 0     0000    C9D4E2C540404040B7306643A1ED9781C9D4E2C540404040B7306643A1ED97810000
33 7EE9D1C4 UOW MATCH                 0     0000    C9D4E2C540404040B7306643A1ED9781C9D4E2C540404040B7306643A1ED97810000
31 7EE9D246 PST MATCH                 768   0300    768
31 7EE9D246   TOKEN FOR 31            768   0300    00000000000000000000000000000000
31 7EE9D246   UOW FOR 31              768   0300    C9D4E2F440404040B7306642B40C3D03C9D4E2C540404040B7306643A59FDF460000
56 7EE9D25A TOKEN MATCH               0     0000    C9D4E2C540404040014CBA2000000001
56 7EE9D25A PSB MATCH                 0     0000    PGMZ111
307 7EE9D25B TRAN MATCHED CNTLCRDS     348   015C    TRN11301
-------------------------------------------------------------------------------------------------------------------------------
```

Figure 238. DFSKSUM0 Logical Record Selection Flow Report

Short Log Summary Report (SUMONLY) Example

Figure 239 on page 573 is an example of a short summary report that DFSKSUM0 creates when the SUMONLY control keyword is supplied. This report is written to the file identified by the REPORT DD statement in the JCL. Figure 239 on page 573 is an example of the DFSKSUM0 short log summary report.

```
* ********************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        1  *
* ********************************************************************************
*                                                                                  *
* ACCOUNTING RECORD AT LSN: 00000002 : IMS/VS STARTED                              *
* ACCOUNTING RECORD AT LSN: 00000437 : FEOV ON SYSTEM LOG                          *
* ACCOUNTING RECORD AT LSN: 00000565 : FEOV ON SYSTEM LOG                          *
*                                                                                  *
* CNTLCRDS:  PGM=BMP255                                                            *
* CNTLCRDS:  SUMONLY                                                               *
*                                                                                  *
* ********************************************************************************
*  IMS TOOL / DFSKSUM              DATE: 2003/102   TIME: 06:08   PAGE:        2  *
* ********************************************************************************
*                                                                                  *
* INPUT LOG DATA SET NAME(S)                                                       *
* S840636.IMSVS.SLDSP.SYS3.D02347.T0924053.V00                                     *
* S840636.IMSVS.SLDSP.SYS3.D02347.T0924454.V00                                     *
*                                                                                  *
* ********************************************************************************
* LOG INFORMATION SUMMARY FOR IMSID: SYS3                                          *
*                                                                                  *
* FIRST LSN: 00000001      LAST LSN: 00000566                                      *
* FIRST SELECTED LSN: 00000001                                                     *
*                                                                                  *
* FIRST LOG RECORD STCK   (UTC): 2002347 1724059     (LOCAL): 2002347 0924059      *
* LAST LOG RECORD STCK    (UTC): 2002348 0049537     (LOCAL): 2002347 1649537      *
* FIRST SELECTED LOG STCK (UTC): 2002347 1724059     (LOCAL): 2002347 0924059      *
* DIFFERENCE BETWEEN UTC AND LOCAL TIME (HHMM): -0800                              *
* ELAPSED TIME ON SELECTED LOG(S):                            000 07:25:47.8       *
*                                                                                  *
*                                                                                  *
* TOTAL # OF LOG RECORDS READ AND PROCESSED     :     1382                         *
* ********************************************************************************
*          END OF IMS LOG SHORT SUMMARY REPORT                                     *
* ********************************************************************************
```

Figure 239. DFSKSUM0 Short Log Summary Report

Chapter 32. Deadlock Trace Record Analysis Utility (DFSKTDL0)

The Deadlock Trace Record Analysis utility is used to format and summarize data extracted from X'67FF' pseudoabend records for database-related deadlocks. These records are identified by a four-character requester identification indicating a pseudoabend condition, and an eight-character element identification that indicates deadlock.

Data describing a single logical deadlock event can span up to a maximum of four physical deadlock pseudoabend records. Although there can be an unlimited number of transactions or jobs participating in a deadlock event, the four pseudoabend records can only contain details about a maximum of nine individual deadlocks between participants. In each deadlock, one participant is identified as the holder of the resource, and one participant is identified as the waiter for the resource.

The Deadlock Trace Record Analysis utility processes the logical deadlock events and the individual deadlocks to produce reports that:

- Provide details about the deadlock
- Show the hierarchy of the participants in the deadlocks (relative to the victim in each deadlock)
- Summarize the deadlock activity, including deadlocks by:
  - Hour
  - DBMS
  - State
  - Lock type
  - DBD
  - PSB
  - Lock name
  - RBA

Selection criteria for the trace entries can include:

- Time range data
- LSN ranges
- Number of records during processing

The Deadlock Trace Record Analysis utility can be invoked using the KBLA panel-driven interface (Option 2.5) or using JCL. Figure 240 on page 576 is an example of the Snap/Pseudo-Abend Record Formatting panel in the KBLA panel-driven interface. DFSKTDL0 can be invoked from this panel.

```
             == K.B.L.A.  Snap/Pseudo-Abend Record Formatting  ==
COMMAND ===>


Input IMS Log DSN IMSDUMP.OLD02.D1203                              Cataloged? Y
IMS Log Version. . . . . 9
Log Formatting Type. . . . K   (B or K)
Log Selection Type: (Only one can be specified)   Specify (Y/N)
 All Types     DB Deadlock Y




Optional Fields
  Start Date/Time (UTC)           -        (YYYYDDD - HHMMSS)
  Stop Date/Time  (UTC)           -        (YYYYDDD - HHMMSS)
  Start LSN . . . . . .                 Stop LSN . . . . . .
  Number of Records to Skip             Number of Records to Process
  Copy images of records

Output DSN Keyword. . . . . .  DEADLOCK   The Output DSN will be:
Log DSNs Were Extracted From RECON.        USERID.keyword.KBLA.R.*
PDS Member Containing Logs/Traces .
```

Figure 240. KBLA Snap/Pseudo-Abend Record Formatting Panel to Invoke DFSKTDL0

The following topics provide additional information:

- "Input and Output for DFSKTDL0"
- "JCL Requirements for DFSKTDL0"
- "Control Statements for DFSKTDL0" on page 578
- "Control Keywords for DFSKTDL0" on page 579
- "Return Codes for DFSKTDL0" on page 580
- "Deadlock Trace Analysis Summary Report Example" on page 580
- "Deadlock Trace Analysis Victim Report Example" on page 583
- "Deadlock Trace Analysis Detail Report Example" on page 584

Input and Output for DFSKTDL0

Types of input to DFSKTDL0 include:

- Control statements to direct processing
- IMS log or trace data sets

Types of output from DFSKTDL0 include:

- Unformatted images of the X'67FF' deadlock pseudoabend records
- Unformatted images of the DIPENTRY and DFSIRPM control blocks associated with the participants in the deadlock
- Statistical and summary reports
- Details about the participants in the deadlock
- Hierarchy of participants in the deadlock
- Informational messages

JCL Requirements for DFSKTDL0

The EXEC statement to run DFSKTDL0 must be in the following form:

```
//RUNTDL0  EXEC  PGM=DFSKTDL0
```

DD Statements

CNTLCRDS (Input)
Contains the control statements for DFSKTDL0. This data set is always required. See “Control Statements for DFSKTDL0” on page 578 for information on these control statements. The DCB parameters for this data set are RECFM=FB,LRECL=80.

DETAIL (Output)
Diagnostic messages and summary reports are written to this data set. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

JOBLIB or STEPLIB (Input)
Describes the library that contains KBLA load modules.

REPORT (Output)
Diagnostic messages and summary reports are written to this data set. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSPRINT (Output)
Messages that are generated during the trace entry extract process are written to this data set. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSUT1 (Input)
Defines the log record data to be processed. It can consist of a single log data set or a concatenation of data sets. This data set is always required. The DCB parameters for this data set vary depending on the DCB that was used to create the log and are taken from the data set label or DCB.

SYSUT4 (Output)
Contains the images of the X'67FF' deadlock pseudo-abend log records. This data set is generally optional; however, it is required when the WRITELOG global keyword control statement has been provided in CNTLCRDS data set. The DCB parameters for this data set vary and must match those of the DCB associated with the SYSUT1 DD statement.

Related Reading: For more information on the WRITELOG global keyword, see “Global Keywords” on page 579.

Note: This data set can become quite large, depending on the size of the SYSUT1 input data set and the number of records that have been processed.

SYSUT5 (Output)
Contains the unformatted images of the DIPENTRY and DFSIRPM control blocks associated with the participants in a logical deadlock event. These control blocks have been extracted from the X'67FF' records. There can be a maximum of nine of these sets of control blocks. The log sequence number associated with the log record from which these control blocks have been extracted is included as a header for each deadlock event. However, if the logical deadlock event spans multiple X'67FF' log records, only the log sequence number of the first log record associated with the event is included in the output file. This data set is generally optional, however, it is required when the WRITEBLOCK global keyword control statement has been provided in the CNTLCRDS data set. The DCB parameters for this data set vary and must match those of the DCB associated with the SYSUT1 DD statement.

Note: This data set can become quite large, depending on the size of the SYSUT1 input data set and the number of records that have been processed.

VICTIM (Output)
Diagnostic messages and summary reports are written. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

JCL Example

The following example shows the JCL used to run DFSKTDL0.

```
//RUNTDL0 EXEC  PGM=DFSKTDL0
//SYSUT1   DD DISP=SHR,
// DCB=BUFNO=10,
// DSN=IMSDUMP.OLD02.D1203
//SYSPRINT DD  SYSOUT=*,DCB=(RECFM=FB,LRECL=133,BLKSIZE=6118)
//VICTIM DD  DSN=IMS.DFSKTDL0.VICTIM,
//  DISP=(NEW,CATLG,CATLG),
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//DETAIL DD  DSN=IMS.DFSKTDL0.DETAIL,
//  DISP=(NEW,CATLG,CATLG),
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//REPORT DD  DSN=IMS.DFSKTDL0.REPORT,
//  DISP=(NEW,CATLG,CATLG),
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//DETAIL DD  DSN=IMS.DFSKTDL0.DETAIL,
//  DISP=(NEW,CATLG,CATLG),
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//REPORT DD  DSN=IMS.DFSKTDL0.REPORT,
//  DISP=(NEW,CATLG,CATLG),
//  UNIT=SYSDA,
//  SPACE=(CYL,(1,1),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA),
//CNTLCRDS DD *
/*
```

Control Statements for DFSKTDL0

Processing for DFSKTDL0 is directed by control statements that are read from the CNTLCRDS file. Control statements are 80-byte fixed length records. Most control statements are optional. The result of omitting a statement is described with each keyword. Comment statements are indicated with an asterisk (*) in column 1. Blank records are ignored. Control statement keywords are coded within the boundaries of columns 1 through 72 and are subject to the following syntax rules:

- Keywords can start in any column.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Multiple keywords are either:
  - Separated by one or more blanks.
  - Specified on multiple control statements.
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement.
- Individual keywords and their associated values cannot span or be continued on multiple control statements.

- Keywords must be written in upper case letters.

Control Keywords for DFSKTDL0

Control statements that can be specified for DFSKTDL0 are either:

- Keywords that indicate global actions
- Keywords that indicate processing options

Global Keywords

Global keywords are optional keywords that influence how the utility is processed. If they are omitted, no optional actions are performed.

WRITEBLOCK
Indicates that the unformatted images of the DIPENTRY and DFSIRPM control blocks associated with the participants in a logical deadlock event are to be written to the data set associated with the WRITEBLOCK DD statement.

WRITELOG
Indicates that the images of the X'67FF' deadlock pseudoabend log records are to be written to the data set associated with the WRITELOG DD statement.

Processing Keywords

Processing keywords are optional keywords that indicate how much of the log is to be processed. If they are omitted, the entire log will be processed.

Restrictions:

- STOPLSN=, STOPSTCK=, and PROCESS= are mutually exclusive.
- STARTLSN=, STARTSTCK= and SKIP= are all mutually exclusive.

PROCESS=
Specifies the number of log records to be processed prior to utility termination. The PROCESS= keyword is optional. If omitted, all records are processed. The format of the PROCESS= keyword is a 1- to 8-digit number.

SKIP=
Specifies the number of log records to be skipped before any records are processed and included in reports. The SKIP= keyword is optional. If omitted, no records are skipped prior to processing. The format of the SKIP= keyword is a 1- to 8-digit number.

STARTLSN=
Specifies the log sequence number of the first log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated log sequence number. If omitted, processing starts at the beginning of the log. The format of the STARTLSN= keyword is an 8-character hexadecimal value.

STARTSTCK=
Specifies the time of the first log data set to be processed. An exact match of time is not required; processing begins with the first record equal to or greater than the indicated time. The STARTSTCK= keyword is optional. If omitted, processing starts at the beginning of the log. The format of the STARTSTCK= keyword is of the format yyyydddhhmmss.

STOPLSN=
Specifies the log sequence number of the last log data set to be processed. An exact match of time is not required; processing stops with the first record equal

to or greater than the indicated time. The STOPLSN= keyword is optional. If omitted, processing continues until end of log. The format of the STOPLSN= keyword is an 8-character hexadecimal value.

STOPSTCK=
Specifies the time of the last log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated time. The STOPSTCK= keyword is optional. If omitted, processing continues until the end of the log. The format of the STOPSTCK= keyword is of the format yyyydddhhmmss.

Return Codes for DFSKTDL0

Code	Meaning
0	Utility has successfully completed.
4	Warning messages were issued.
8	Utility terminated before completion.

Deadlock Trace Analysis Summary Report Example

The summary report created by DFSKTDL0 is written to the file identified by the REPORT DD statement in the JCL. This example shows a Deadlock Trace Analysis Summary report. In this example:

- The report included four deadlock trace records where the number of participants in the deadlock exceeded nine, the maximum number of participants for which detail can be stored for a single deadlock event. **Note:** The four deadlock trace records represented a total of six deadlocks for which there were no details available.
- The log selected was IMSVS.DEADLOCK.TESTLOG.
- The length of the trace header was indicated.
- The length of a deadlock entry was indicated.
- The time period processed on the log was displayed.
- The first trace record on the log was also the first record processed on the log (no records were skipped).
- The log sequence number range represented on the log was displayed. Although the log sequence number is actually an 8-byte field, only the last 4 bytes are presented with KBLA.
- No records were read from the CNTLCRDS file.
- No records were skipped.
- 4474 log records were read.
- All 4474 log records were X'67FF' trace records.
- All of the trace records were evaluated.
- 2880 records were written to the detail report.
- 2985 records were written to the victim report.
- Of the 4474 deadlock records:
  - 1333 physical log records represented the complete logical deadlock event.
  - 1547 records represented the first physical log record where the logical deadlock event spanned multiple physical log records.
  - 1594 represented the second or subsequent physical log records where the logical deadlock event spanned multiple physical log records.

- No records had an error in which the number of deadlock control blocks contained in the deadlock record exceeded the bucket size, or number of entries expected to be on the record.
- The largest cycle count, or number of participants in the deadlock event, was 11.
- The largest record capacity encountered was 9.
- The total number of deadlocks was 7464.
- The total number of deadlocks for which details were available was 7458. Details were not available for the six remaining deadlocks.
- Deadlock activity was summarized by:
  - Hour
  - DBMS
  - State
  - Lock type
  - DBD
  - PSB
  - Lock name
  - RBA

```
******************************** TOP OF DATA ********************************
* ****************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        1
* ****************************************************************************
*
*
*
* DEADLOCK COUNT EXCEEDS SNAP RECORD LIMIT AT LSN: 64207207  RECORD# :      319
*    RECORD CAPACITY:       9  DEADLOCK CNT:        10
* DEADLOCK COUNT EXCEEDS SNAP RECORD LIMIT AT LSN: 64207E11  RECORD# :      323
*    RECORD CAPACITY:       9  DEADLOCK CNT:        11
* DEADLOCK COUNT EXCEEDS SNAP RECORD LIMIT AT LSN: 64207FB6  RECORD# :      327
*    RECORD CAPACITY:       9  DEADLOCK CNT:        10
* DEADLOCK COUNT EXCEEDS SNAP RECORD LIMIT AT LSN: 6AC8EB7F  RECORD# :     4189
*    RECORD CAPACITY:       9  DEADLOCK CNT:        11
*
* INPUT LOG DATA SET NAME(S)
* IMSVS.DEADLOCK.TESTLOG
*
* ****************************************************************************
*             DEADLOCK TRACE INFORMATION SUMMARY
*
* TRACE HEADER LENGTH         :       48
* DEADLOCK ENTRY LENGTH       :      428
*
*
* TIME STAMP ON FIRST TRACE RECORD              : 2003.190 21:02:34.313915
* TIME STAMP ON FIRST PROCESSED RECORD          : 2003.190 21:02:34.313915
* TIME STAMP ON LAST PROCESSED TRACE RECORD     : 2003.191 20:31:03.017499
* LSN ON FIRST TRACE RECORD                    : 5820C9F2
* LSN ON FIRST PROCESSED RECORD                : 5820C9F2
* LSN ON LAST PROCESSED TRACE RECORD           : 705DDBBE
*
* TOTAL # OF NON COMMENT CNTLCRDS RECORDS READ    :       0
*
* REQUESTED # OF LOG RECORDS TO BE SKIPPED        :       0
* TOTAL # OF LOG RECORDS SKIPPED                  :       0
*
* TOTAL # OF LOG RECORDS READ                     :    4474
* TOTAL # OF 67FF TRACE RECORDS READ              :    4474
* TOTAL # OF 67FF TRACE RECORDS EVALUATED         :    4474
* TOTAL # OF RECORDS WRITTEN TO DETAIL REPORT     :    2880
* TOTAL # OF RECORDS WRITTEN TO VICTIM REPORT     :    2985
```

Summary Report Example

```
*
* TOTAL # OF DEADLOCK RECORDS EVALUATED          :     4474
* TOTAL # OF COMPLETE DEADLOCK RECORDS           :     1333
* TOTAL # OF MULTI-RECORD DEADLOCK RECORDS       :     1547
* TOTAL # OF ADDITIONAL PARTS FOR DEADLOCK RECS  :     1594
* TOTAL # OF DEADLOCKS EXCEEDING RECORD CAPACITY :        4
* TOTAL # OF RECORDS EXCEEDING BUCKET SIZE       :        0
* TOTAL # OF DEADLOCK SITUATIONS ANALYZED        :     2880
*
* LARGEST CYCLE COUNT ENCOUNTERED                :       11
* LARGEST BUCKET COUNT ENCOUNTERED               :        9
* TOTAL NUMBER OF DEADLOCKS                      :     7464
* TOTAL NUMBER OF DEADLOCK ENTRIES WITH DETAILS  :     7458
*


* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        2
* ********************************************************************************
*
*              DEADLOCKS BY HOUR
* START TIME        STOP TIME               COUNT
*
* 2003190/210234 -  2003190/222241           144
* 2003190/222241 -  2003190/230053            12
* 2003190/230053 -  2003191/003002             6
*
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        4
* ********************************************************************************
*
*              DEADLOCKS BY DBMS
* DBMS                 COUNT
*
* PROD             7458
*
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        5
* ********************************************************************************
*
*              DEADLOCKS BY STATE
* STATE           COUNT
*
* 00                1650
* 01                 170
* 03                 262
* 04                5376
*
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        6
* ********************************************************************************
*
*              DEADLOCKS BY LOCKTYPE
* LOCKTYPE        COUNT
*
* GFPLL            7108
* GRIDX             350
*
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:
* ********************************************************************************
*
*     DEADLOCKS BY DBD (PSB WITHIN DBD)
*                               COUNT
*
* DBD: DATABAS1                   6
*       PSB: PSB1                   6
* DBD: DATABAS2                   1
```

```
*       PSB: PSB2                1
* DBD: DATABAS3                2
*       PSB: PSB2                2
* DBD: DATABAS4                4
*       PSB: PSB1                2
*       PSB: PSB2                2
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:       17
* ********************************************************************************
*
*     DEADLOCKS BY PSB (DBD WITHIN PSB)
*                               COUNT
*
* PSB: PSB1                      5
*       DBD: DATABAS1            2
*       DBD: DATABAS2            3
* PSB: PSB2                   1949
*       DBD: DATABAS2            5
*       DBD: DATABAS3           33
*       DBD: DATABAS4         1911
* PSB: PSB3                   3379
*       DBD: DATABAS5            2
*       DBD: DATABAS6            3
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:       25
* ********************************************************************************
*
*              DEADLOCKS BY LOCKNAME
*  RBA/RBN DMB# DCB# TYPE       COUNT
*
* 00000010 FDDD  00  C6             1
* 00000010 FDE3  00  C6             1
* 00000010 FDE5  00  C6             1
* 00000010 FE15  00  C6             1
* 00000010 FE16  00  C6           111
* ********************************************************************************
* 1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:       42
* ********************************************************************************
*
*              DEADLOCKS BY RBA
* RBA                         COUNT
*
* 003071D0                       1
* 0034CD50                       1
* 0035D030                       1
* 003A7300                       1
********************************************************************************
```

Deadlock Trace Analysis Victim Report Example

The victim report created by DFSKTDL0 is written to the file identified by the VICTIM DD statement in the JCL. This example shows a Deadlock Trace Analysis Victim report. In this example, 7 deadlock events are displayed, including:

- The first deadlock event represented a 2-way deadlock where Tran/JOB S00, which ran on IMS subsystem PROD in PST X'71', was the victim. TRAN1 benefited when the lock held by S00 was released.
- The second deadlock even represented a 2-way deadlock where JOB1 was the victim. TRAN2 benefited when the lock held by JOB1 was released.
- The fourth deadlock event represented a 3-way deadlock where JOB1 was the victim. TRAN3 benefited when the lock held by JOB1 was released; TRAN 1 benefited when the lock held by TRAN3 was released.

Victim Report Example

```
********************************* TOP OF DATA **********************************
1 IMS TOOL / DFSKTDL0            DATE: 2004/161   TIME: 14:56   PAGE:        1
 1ST-LSN   TIME         CNT  TRAN/JOB DBMS-PST   TRAN/JOB DBMS-PST   TRAN/JOB DBM
 --------  ----------  ---  -------- --------   -------- --------   -------- ---

 5820C9F2  21:02:34.3    2  TRAN1    (PROD- 55)  S00      (PROD- 71)V

 5831D2F6  21:04:55.3    2  TRAN2    (PROD-139)  JOB1     (PROD-228)V

 58332504  21:05:06.0    2  TRAN1    (PROD-100)  TRAN2    (PROD- 54)V

 583394BD  21:05:09.9    3  TRAN1    (PROD-139)  TRAN3    (PROD-100)  JOB1     (PROD-54)V

 5834DE7E  21:05:21.4    2  TRAN3    (PROD-100)  TRAN5    (PROD- 54)V

 5834F6E8  21:05:22.3    2  TRAN3    (PROD-100)  TRAN5    (PROD- 54)V

 583665F2  21:05:36.2    2  TRAN1    (PROD-100)  TRAN9    (PROD-139)V
```

Deadlock Trace Analysis Detail Report Example

The detail report created by DFSKTDL0 is written to the file specified by the DETAIL DD statement in the JCL. This example shows a Trace Analysis Detail report. In this example, 3 deadlock events are displayed:

- The first deadlock event represented a 2-way deadlock. The deadlock entry data did not include the keys for the database records involved.
- The second deadlock event represented a 2-way deadlock. The deadlock entry data did not include the keys for the database records involved.
- The third deadlock event represented a 3-way deadlock. The keys to the database records involved in the deadlock were displayed.

```
IMS TOOL / DFSKTDL0            DATE: 2004/179   TIME: 13:08   PAGE:        1
# 1ST-LSN  VIC DMB-NAME PCB--DBD RBA/RBN  DMB# DCB# TYPE   IMS-NAME TRAN/JOB PSB-NAME PST RGN CALL LOCKFUNC STATE
 - -------- --- -------- -------- -------(LOCKNAME)-------  -------- -------- -------- --- --- ---- -------- -----

** 00:28:19.1 ************************************************************
1 D9FD98A1     DBDDAP   DBDDAP   00AAB008 84BF  01  400002 IMS1     ARS1047  PSB142CP  42 DBT GET  GRIDX      06-P
  KEY FOR RESOURCE IS NOT AVAILABLE

 2           V  DBDDAP   DBDDAP   06A0A004 83D9  01  400002 IMS1     ARS1047  PSB12CP  246 DBT GET  GRIDX     06-P
   KEY FOR RESOURCE IS NOT AVAILABLE

** 00:28:21.1 ************************************************************
 1 D9FD98A1     DBDDAP   DBDDAP   00AAB008 84BF  01  400002 IMS1     ARS1047  PSB142CP  42 DBT GET  GRIDX     06-P
   KEY FOR RESOURCE IS NOT AVAILABLE

 2           V  DBDDAP   DBDDAP   06A0A004 83D9  01  400002 IMS1     ARS1047  PSB12CP  246 DBT GET  GRIDX     06-P
   KEY FOR RESOURCE IS NOT AVAILABLE

** 00:35:18.1 ************************************************************
 1 DA15F71D     DBDDAP   DBDDAP   003E700C 8CBA  01  400002 IMS1     ARS1047  PSB146CX  34 DBT ISRT GRIDX     06-P
   KEY: C7C9F5F7
 2 DA15F71D     DBDDAP   DBDDAP   003E700C 8CBA  01  400002 IMS1     ARS2047  PSB246CX  37 DBT ISRT GRIDX     06-P
   KEY: C7C9F5F9
 3           V  DBDDAP   DBDDAP   03674004 84BF  01  400002 IMS1     ARS1047  PSB146CX  71 DBT GET  GRIDX     06-P
   KEY: C7D3D340F3F1F7F4F8F0404040
```

Chapter 33. Trace Record Extract Utility (DFSKXTR0)

The need for information for problem diagnostics or accumulation of statistics drives trace table logging, which often generates a large number of records. The Trace Record Extract utility (DFSKXTR0) reads an IMS log data set (OLDS/SLDS) or trace data set (DFSTRAxx) to produce a subset of information that meets specific selection criteria.

Unlike DFSERA10 which searches entire log records for specific strings, DFSKXTR0 searches individual trace table entries using selection criteria. Trace table entries are relatively small, 32- or 64-byte entries. Although the data in the entries can vary depending on what is specifically being traced, the structure is a constant eight words of data.

To avoid a potentially high I/O overhead of writing an individual log record for each trace table entry, multiple individual trace table entries are grouped in a blocked log record. A log record, for example, could be 4K in size and contain either 123 32-byte individual trace table entries or 62 64-byte individual trace table entries. Log records also contain a 64-byte header, which contains a two-character name of the trace type, a time stamp, indicators of how many trace entries are contained in the record, and an offset to the next trace table entry. Multiple trace types can be generated; however, all trace table entries in a log record are of the same type.

After searching the trace table entries, DFSKXTR0 stores the entries that match selection criteria into new log records. These new log records can subsequently be passed to the DFSERA60 exit for formatting.

Selection criteria for the trace table entries can include:

- Trace table IDs
- Character string searches at the trace entry level
- Specific words, half words or bytes in the trace entries
- Time range data
- Entire log records to be matched
- Number of records during processing
- Mode of SCAN to read the log records without actual processing

Search criteria is entered as a paired specification identifying the word, half word, or byte to be examined, and the associated data value. Optionally, the entire log record containing the matching trace table entries can also be extractedl.

The Trace Record Extract utility can be invoked using the KBLA panel-driven interface (Option 4.1.2) or using JCL. Figure 241 on page 586 is an example of the Trace Entry Filtering panel in the KBLA panel-driven interface. DFSKXTR0 can be invoked from this panel.

```
             == K.B.L.A.  Trace Entry Filtering ==
COMMAND ===>

Input IMS Log DSN IMSDUMP.OLD02.D1203                          Cataloged? Y
IMS Log Version . . . . 9

Trace Table Ids:  DL
Search Criteria:
 1: B01  01
 2: B01  03
 3:
 4:
 5:
 6:
 7:

  Optional Fields For Trace Records Filtering
     Start Date/Time (UTC)          -        (e.g YYYYDDD-HHMMSS)
     Stop Date/Time  (UTC)          -        (e.g YYYYDDD-HHMMSS)
     Records to Skip. . . .             Records to Process. . .
     Scan Only . .          Merge       Extract Log Record. . .
Output DSN Keyword. . . . . . . . . .
Log DSNs were extracted from RECON. .
PDS member containing logs  . . . . .
```

Figure 241. KBLA Trace Entry Filtering Panel for to Invoke DFSKXTR0

The following topics provide additional information:

- "Input and Output for DFSKXTR0"
- "JCL Requirements for DFSKXTR0"
- "Control Statements for DFSKXTR0" on page 588
- "Control Keywords for DFSKXTR0" on page 588
- "Return Codes for DFSKXTR0" on page 591
- "Trace Entry Extract Summary Report Example" on page 592

Input and Output for DFSKXTR0

Types of input to DFSKXTR0 include:

- Control statements to direct processing
- IMS Log or Trace data sets

Types of output from DFSKXTR0 include:

- Log records modified to contain only the trace entries matching the search criteria
- Images of the original, unmodified log records
- Statistical and summary report
- Informational messages

JCL Requirements for DFSKXTR0

The EXEC statement to run DFSKXTR0 must be in the following form:

```
//RUNXTR0  EXEC  PGM=DFSKXTR0
```

DD Statements

CNTLCRDS (Input)
Contains the control statements for DFSKXTR0. This data set is always

required. The DCB parameters for this data set are RECFM=FB,LRECL=80. For information on CNTLCRDS control statements, see “Control Statements for DFSKXTR0” on page 588.

JOBLIB or STEPLIB (Input)
Describes the library that contains KBLA load modules.

REPORT (Output)
Diagnostic messages and summary reports are written to this data set. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSPRINT (Output)
SYSPRINT is a data set into which messages generated during the trace entry extract process are written. This data set is always required. The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSUT1 (Input)
Defines the log record data to be processed. It can consist of a single log data set, or a concatenation of data sets. This data set is always required. The DCB parameters for this data set vary, depending on the DCB that was used to create the log, and are taken from the data set label or DCB.

SYSUT4 (Output)
Contains the modified log records generated to contain the trace entries which match the specified search criteria. This data set is required. The DCB parameters for this data set vary, and must match those of the DCB associated with the SYSUT1 DD statement.

Note: This data set can become quite large, depending on the size of the SYSUT1 input data set and the number of records that have been processed.

WHOLEREC (Output)
Contains images of the log records that contain trace entries matching the specified search criteria. This data set is optional. It is required when the WHOLEREC global keyword control statement has been provided in CNTLCRDS. See “Control Statements for DFSKXTR0” on page 588 for more information on CNTRLCRDS. The DCB parameters for this data set vary, and must match those of the DCB associated with the SYSUT1 DD statement.

Note: This data set can become quite large, depending on the size of the SYSUT1 input data set and the number of records that have been processed.

JCL Example

The following example shows the JCL used to run DFSKXTR0.

```
//RUNXTR0 EXEC  PGM=DFSKXTR0
//SYSUT1   DD DISP=SHR,
// DCB=BUFNO=10,
//  DSN=IMSDUMP.TRC02.D1203
//REPORT   DD DISP=(NEW,CATLG),
//  DSN=IMSVS.DFSKXTR0.REPORT
//  UNIT=SYSDA,
//  SPACE=(CYL,(1,1),RLSE),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//SYSPRINT DD SYSOUT=*,
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FB)
//SYSUT4   DD DISP=(NEW,CATLG),
//  DSN=IMSVS.DFSKXTR0.SYSUT4,
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(LRECL=32756,BLKSIZE=32760,RECFM=VB)
 //CNTLCRDS DD *
```

```
SEARCH  W*=44912998
SEARCH  W*=46317700
SEARCH  H4=0003
SEARCH  W2=00000003
TRACETYPE=RR
TRACETYPE=OA
```

Control Statements for DFSKXTR0

Processing for DFSKXTR0 is directed by control statements that are read from the CNTLCRDS file. Control statement records are 80-byte fixed length records. Most control statements are optional. The result of omitting a statement is described with each keyword. Comment statements are indicated with an asterisk (*) in column 1. Blank records are ignored. Control statements keywords are coded within the boundaries of columns 1 through 72, and are subject to the following syntax rules:

- Keywords can start in any column.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Multiple keywords are either:
  - Separated by one or more blanks.
  - Specified on multiple control statement.
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement.
- Individual keywords and their associated values cannot span or be continued on multiple control statements.
- Keywords must be written in upper case letters.

Control Keywords for DFSKXTR0

Control statements that can be specified include:

- Keywords that indicate global actions
- Keywords that indicate processing options
- Keywords that indicate trace table log record search criteria
- Keywords that indicate trace table entry search criteria

Global Keywords

Global keywords are optional keywords that influence how the utility is processed. If they are omitted, no optional actions are performed.

NOWRITE
Indicates that no actual records are to be written to the SYSUT4 or WHOLEREC data sets; instead, the summary report that is generated indicates the number of records that would have been processed.

WHOLEREC
Indicates that the original log records that contain at least one trace entry that matches search criteria are to be written to the data set associated with the WHOLEREC DD statement.

Processing Keywords

Processing keywords are optional keywords that indicate how much of the log is to be processed. If they are omitted, the entire log is processed.

Restrictions:

- MATCHLIM=, PROCESS=, and STOPSTCK= are mutually exclusive.
- SKIP= and STARTSTCK= are mutually exclusive.

MATCHLIM=
Specifies the number of trace entry matches that should be made prior to utility termination. It can be used to validate search criteria without processing an entire log of data. The PROCESS= keyword is optional. If omitted, all records are processed. The format of the PROCESS= keyword is a 1- to 8-digit number.

PROCESS=
Specifies the number of log records that should be processed prior to utility termination. The PROCESS= keyword is optional. If omitted, all records are processed. The format of the PROCESS= keyword is a 1- to 8-digit number.

SKIP=
Specifies the number of log records that should be skipped before any records are processed and included in reports. The SKIP= keyword is optional. If omitted, no records will be skipped prior to processing. The format of the SKIP= keyword is a 1- to 8-digit number.

STARTSTCK=
Specifies the time when the first log data set will be processed. An exact match of time is not required; processing begins with the first record equal to or greater than the indicated time. The STARTSTCK= keyword is optional. If omitted, processing starts at the beginning of the log. The format of the STARTSTCK= keyword is of the format yyyydddhhmmss.

STOPSTCK=
Specifies the time of the last log data set to be processed. An exact match of time is not required; processing stops with the first record equal to or greater than the indicated time. The STOPSTCK= keyword is optional. If omitted, processing continues until the end of the log. The format of the STOPSTCK= keyword is of the format yyyydddhhmmss.

Trace Table Log Search Keywords

Trace table log search keywords identify trace table log records to be evaluated for processing. These keywords might be required or optional.

SEARCH
Indicates that the trace table entry search criteria keywords that follow are to be used in a boolean 'and' search of the trace table entries. At least one occurrence of the SEARCH followed by associated trace table entry search criteria keywords is required. Multiple occurrences of the SEARCH keyword are allowed; however, each use of the keyword and its associated set of trace table entry search criteria keywords must be coded on a separate line. In this case, each separate occurrence of the SEARCH keyword is treated as a boolean 'or'.

Restrictions: None.

TRACETYPE=
Used to select specific trace table names for processing. If multiple trace tables are to be processed, each must be specified with a separate TRACETYPE= keyword; however, an unlimited number of such specifications is supported. The TRACETYPE= keyword is optional. If it is omitted, all of the trace tables in the log record will be processed. The format of the TRACETYPE= keyword is a 2-character value.

Restrictions: None.

Trace Table Entry Search Keywords

Trace table entry search keywords help locate trace table entries within a trace table log record. Trace table entry search keywords are used with the SEARCH keyword. At least one of these keywords is required.

A trace table entry can be either 32- or 64-bytes long. A 32-byte trace table entry can consist of 8 words or 16 half words. A 64-byte trace table entry can consist of 16 words or 32 half words. For example, a 32-byte trace table entry might look like this sample:

```
   Word0   Word1    Word2    Word3    Word4    Word5    Word6    Word7
'00010000 04042FFF 90AB3400 00000000 121234FF FFFFFFFF 00000001 00001999'X
```

DFSKXTR0 uses the following conventions to address the words, half words, or bytes within a trace table entry:

- W0 - WF, which represents words 0 through F
- H00 - H1F, which represents half words 00 through 1F
- B00 - B3F, which represents bytes 0 through 3F

Bxx=

Indicates that this byte in the trace table entry should be evaluated for the indicated value. The Bxx= keyword is optional; however, at least one trace table entry search criteria keyword is required to be associated with each SEARCH keyword. The format of the Bxx= keyword is a 2-digit hexadecimal value.

'xx' can be one of the following values:

- 00 - 1F, corresponding to bytes 0 through 3F
- '*,' indicating that the associated value can be found in any byte

Restrictions: None

Hxx=

Indicates that this half word in the trace table entry should be evaluated for the indicated value. The Hxx= keyword is optional; however, at least one trace table entry search criteria keyword is required to be associated with each SEARCH keyword.

The format of the Hxx= keyword is Hxx=<value> where <value> is a 4-digit hexadecimal value.

'x' can be one of the following values:

- 00 - 1F, corresponding to half words 00 through 1F
- '*,' indicating that the associated value can be found in any half word

Restrictions: None

Wx=

Indicates that this word in the trace table entry should be evaluated for the indicated value. The Wx= keyword is optional; however, at least one trace table entry search criteria keyword is required to be associated with each SEARCH keyword. The format of the Wx= keyword is an 8-digit hexadecimal value.

'x' can be one of the following values:

- 0 - F, corresponding to words 0 through F
- '*,' indicating that the associated value can be found in any word

Restrictions: None

Example of Search Criteria for Trace Table Entry Selection

The output in Figure 242 would be returned if one of these control statements was specified:

- `SEARCH  W*=00000001`
- `SEARCH W6=00000001`

```
W0        W1        W2        W3        W4        W5        W6        W7       <Word
H00 H01   H02 H03   H04 H05   H06 H07   H08 H09   H0A H0B   H0C H0D   H0E H0F  <Half
B00       B04       B08       B0C       B10       B14       B18       B1C      <Byte
00010000  04042FFF  90AB3400  00000000  121234FF  FFFFFFFF  00000001  00001999 <Entry
```

Figure 242. Example Output from Trace Table Entry Selection

Three types of boolean searches can also be used to return this entry selection:

- An 'and' search. For example, specifying either `SEARCH W6=00000001 H0=0001` or `SEARCH W6=00000001 H*=0001` would return the example entry shown in Figure 242, while specifying `SEARCH W6=00000001 H1=0001` would not.
- An 'or' search. For example, by indicating multiple search statements, the combination of `SEARCH  H0=0001` and `SEARCH  H1=0001` would return the example entry shown in Figure 242.
- A combination of an 'and' search and an 'or' search. For example, the combination of `SEARCH W6=00000001  H0=0001` and `SEARCH W6=00000001  H1=0001` would return the example entry shown in Figure 242.

Once a trace table entry has been identified, it can be used to reduce output in DFSERA60 reports. The log record containing the identified trace table entry is extracted, reformatted by DFSKXTR0, then passed as input to DFSERA60 for formatting. Figure 243 is an example of a DFSERA60 report that has not been reformatted with DFSKXTR0. Figure 244 shows how the same DFSERA60 report would look after DFSKXTR0 reformatting.

```
FUNCTION    WORD 0    WORD 1   WORD 2  WORD 3   WORD 4   WORD 5   WORD 6   WORD 7
DL7 TRACE TABLE - DATE 2004040 TIME 171902077196 OFFSET 032D SKIP 0000 TOTAL SKIP
DEADLOCK * 00010000 03171060 0116A060 00000000 D7D3C1D7 D1D2F2F3 00000001 E3D2C440
.
.        Data line repeated 121 additional times
.
DEADLOCK * C70123CC 03171060 0116A060 00044000 D7A3C1A7 D1D2F2F3 00000000 E3D2C440
```

Figure 243. Example of a DFSERA60 Report Before DFSKXTR0 Reformatting

```
FUNCTION        WORD 0    WORD 1    WORD 2    WORD 3    WORD 4    WORD 5    WORD 6    WORD 7
DL7 TRACE TABLE - DATE 2004040 TIME 171902077196 OFFSET 032D SKIP 0000 TOTAL SKIP
DEADLOCK    *  00010000  03171060  0116A060  00000000  D7D3C1D7  D1D2F2F3  00000001  E3D2C440
```

Figure 244. Example of a DFSERA60 Report After DFSKXTR0 Reformatting

Return Codes for DFSKXTR0

Code	Meaning
0	Utility was successfully completed.
4	Warning messages were issued.
8	Utility terminated before completion.

Trace Entry Extract Summary Report Example

The summary report created by DFSKXTR0 is written to the file identified by the REPORT DD statement in the JCL. This example shows a trace entry extract summary report. In this example:

- Six records are read from the CNTLCRDS file. Itemized breakdowns are shown for each of the 6 search criteria.
  - A search was done for the value X'44912998' in any word.
  - A search was done for the value X'46317700' in any word.
  - A search was done for the value X'0003' in half word 4.
  - A search was done for the value X'00000003' in word 2.
  - The resource recovery services trace table (type RR) was processed.
  - The OTMA trace table (type OA) was processed.
- The log selected was `IMSDUMP.TRC02.D1203`.
- The time period processed on the log was displayed.
- The first trace record on the log is also the first record processed on the log (no records were skipped).
- The last record that matched some search criteria was not the last record processed in the log.
- 90000 log records were read from the log.
  - All 90 000 log records were X'67FA' (trace table log records).
  - All 90 000 log records were processed.
  - 24 413 of the 90 000 log records matched the search criteria. Only records containing the matching trace table entries were written to the SYSUT4 file.

    No log records were written to the WHOLEREC data set because the WHOLEREC keyword was not included in the CNTLCRDS file. Had this keyword been included, counts indicating the number of records written to this file would have been displayed.
  - The 90 000 log records contained 11 070 000 trace table entries.

    Note: The trace table log record header (the first two 32–byte entries) are included in the count.
  - 114 787 trace table entries matched some search criteria.
- For each statement, the number of trace table entries that match this search criteria is shown. If a trace record matched multiple sets of search criteria, the statistics are shown for only the first matching search criteria statement.
- For each statement, the relative location of the log record is displayed showing the place in the log where the first and last trace table entry matches were found. In this case, the relative number of records in the log file range from 1 to 90 000.

```
* ********************************************************************************
*  IMS TOOL / DFSKXTR0             DATE: 2004/160   TIME: 10:36   PAGE:        1
* ********************************************************************************
*
* CNTLCRDS:  SEARCH  W*=44912998
* CNTLCRDS:  SEARCH  W*=46317700
* CNTLCRDS:  SEARCH  H04=0003
* CNTLCRDS:  SEARCH  W2=00000003
* CNTLCRDS:  TRACETYPE=RR
* CNTLCRDS:  TRACETYPE=OA
*
*
* INPUT LOG DATA SET NAME(S)
* IMSDUMP.TRC02.D1203
*
```

```
* ********************************************************************************
*               LOG INFORMATION SUMMARY
*
*
* TIME STAMP ON FIRST TRACE RECORD            : 2003.331 09:06:24.592339
* TIME STAMP ON FIRST PROCESSED RECORD        : 2003.331 09:06:24.592339
* TIME STAMP OF FIRST LOG WITH CRITERIA MATCH : 2003.331 09:06:25.132606
* TIME STAMP ON LAST PROCESSED TRACE RECORD   : 2003.331 20:30:58.041356
*
* TOTAL # OF NON COMMENT CNTLCRDS RECORDS READ  :        6
* TOTAL # OF TRACE TABLE TYPES SELECTED         :        2
*   TRACE TABLE TYPE RR SELECTED
*   TRACE TABLE TYPE OA SELECTED
* TOTAL # OF SEARCH CRITERIA STATEMENTS READ    :        4
*
* REQUESTED # OF LOG RECORDS TO BE SKIPPED      :        0
* TOTAL # OF LOG RECORDS SKIPPED                :        0
*
* TOTAL # OF LOG RECORDS READ                   :    90000
* TOTAL # OF 67FA LOG RECORDS READ              :    90000
* TOTAL # OF 67FA LOG RECORDS EVALUATED         :    90000
* TOTAL # LOG RECORDS MATCHING SEARCH CRITERIA  :    24413
* TOTAL # REFORMATTED LOG RECORDS WRITTEN       :    24413
*
* TOTAL # OF TRACE ENTRIES EVALUATED            : 11070000
* TOTAL # OF TRACE ENTRIES MATCHING CRITERIA    :   114787
*
*        1 SEARCH CRITERIA FOR STATEMENT   1
*            W*=44912998
*          MATCHES FOR THIS STATEMENT           :        0
*          RELATIVE TRACE RECORD OF FIRST MATCH :        0
*          RELATIVE TRACE RECORD OF LAST MATCH  :        0
*
*        1 SEARCH CRITERIA FOR STATEMENT   2
*            W*=46317700
*          MATCHES FOR THIS STATEMENT           :    30582
*          RELATIVE TRACE RECORD OF FIRST MATCH :    47699
*          RELATIVE TRACE RECORD OF LAST MATCH  :    89776
*
*        1 SEARCH CRITERIA FOR STATEMENT   3
* ********************************************************************************
*  IMS TOOL / DFSKXTR0             DATE: 2004/160   TIME: 10:36   PAGE:        2
* ********************************************************************************
*
*           HWORD 04 HAS SEARCH CRITERIA APPLIED
*            H04=0003
*          MATCHES FOR THIS STATEMENT           :    84205
*          RELATIVE TRACE RECORD OF FIRST MATCH :        3
*          RELATIVE TRACE RECORD OF LAST MATCH  :    89999
*
*        1 SEARCH CRITERIA FOR STATEMENT   4
*           WORD 02 HAS SEARCH CRITERIA APPLIED
*            W2=00000003
*          MATCHES FOR THIS STATEMENT           :        0
*          RELATIVE TRACE RECORD OF FIRST MATCH :        0
*          RELATIVE TRACE RECORD OF LAST MATCH  :        0
*
* ********************************************************************************
```

Chapter 34. Log Record Processing Rate Analysis Utility (DFSKRSR0)

The Log Record Processing Rate Analysis utility (DFSKRSR0) is used to generate reports that summarize the volume of the log data that is being generated by an IMS subsystem. The volume of log data is expressed in number of records per second and the number of bytes per second. The detailed log record processing rate data is broken down by log record type, and by subtype within record type, if requested.

The Log Record Processing Rate Analysis utility can be used to:

- Determine the size of log data sets or archiving frequency
- Track data volume for Remote Site Recovery (RSR)

Selection criteria for the DFSKRSR0 trace table entries can include:

- Log record type
- Subtypes within log record types
- Time range data
- Log sequence number ranges
- Number of records to be processed or skipped

On an IMS subsystem, the log record generation rate can vary depending on system activity. An option is available to sample the system logging rate at specified time intervals, to track differences in system activity.

The Log Record Processing Rate Analysis utility can be invoked using the KBLA panel-driven interface (Option 4.7 “Log Processing Rate Analysis”) or using JCL. Figure 245 is an example of the Log Processing Rate Analysis panel in the KBLA panel-driven interface.

```
             == K.B.L.A.  Log Processing Rate Analysis  ==
COMMAND ===>

Input IMS Log DSN IMSVS.TESTLOG                                Cataloged? Y
IMS Log Version. . . . . 9

 Selection by log type:
  Log Types:  01   03



Optional Fields
  Include breakdown by Subtype    (Y/N)   Analysis Interval 10   (Minutes)
  Start Date/Time (UTC)           -        (YYYYDDD - HHMMSS)
  Stop Date/Time  (UTC)           -        (YYYYDDD - HHMMSS)
  Start LSN . . . . . .                  Stop LSN . . . . . .
  Number of Records to Skip              Number of Records to Process

Output DSN Keyword. . . . . ANALYSIS    The Output DSN will be:
Log DSNs Were Extracted From RECON.     USERID.keyword.KBLA.R.*
PDS Member Containing Logs/Traces .
```

Figure 245. KBLA Log Processing Rate Analysis Panel to Invoke DFSKRSR0

The following topics provide additional information:

- “Input and Output for DFSKRSR0” on page 596
- “JCL Requirements for DFSKRSR0” on page 596

Input and Output for DFSKRSR0

Types of input to DFSKRSR0 include:

- Control statements to direct processing
- Descriptive titles for log record types
- IMS log or trace data sets

Types of output from DFSKRSR0 include:

- Statistical and summary reports
- Details about the participants
- Informational messages

JCL Requirements for DFSKRSR0

The EXEC statement to run DFSKRSR0 must be in the following form:

```
//RUNTDL0  EXEC  PGM=DFSKRSR0
```

DD Statements for DFSKRSR0

CNTLCRDS (Input)
Contains the control statements for DFSKRSR0. This data set is always required.

The DCB parameters for this data set are RECFM=FB,LRECL=80.

Related Reading: See "Control Statements for DFSKRSR0" on page 598 for more information on the CNTLCRDS control statements.

DETAIL (Output)
Contains the originally unformatted data that was formatted and written to the REPORT file. The DETAIL file can be sorted to present the data in an order different from that in the REPORT file. This data set is always required

The DCB parameters for this data set are RECFM=FB,LRECL=100.

Related Reading: See "DETAIL File Layout" on page 600 for more information on the DETAIL record.

JOBLIB or STEPLIB (Input)
Describes the library that contains KBLA load modules.

LOGDESC (Input)
Contains entries for every log record type and subtype that could be found in the log data set. It is used to generate descriptive titles for each record type in the Log Record Processing Rate Analysis report. This data set is always required.

The DCB parameters for this data set are RECFM=FB,LRECL=80.

REPORT (Output)
Diagnostic messages and summary reports are written to this data set. This data set is always required.

The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSPRINT (Output)
A data set into which messages that were generated during the log record processing rate analysis are written. This data set is always required.

The DCB parameters for this data set are RECFM=FBA,LRECL=133.

SYSUT1 (Input)
Defines the log record data to be processed. It may consist of a single log data set or a concatenation of data sets. This data set is always required.

The DCB parameters for this data set vary depending on the DCB that was used to create the log and are taken from the data set label or DSCB.

JCL Example

The following example shows the JCL used to run DFSKRSR0.

```
//*****************************************************************
//*** STEP 3 ******************************************************
//*****************************************************************
//RUNLGD  EXEC  PGM=DFSKLGD0
//LOGDIN   DD DISP=SHR,
//  DSN=STLSERV.QPPTEST.IMS910.SDFSPLIB(DFSKDESC)
//LOGDOUT  DD DISP=(NEW,PASS),
//  DSN=&LOGDOUT,
//  UNIT=SYSDA,SPACE=(TRK,(1,1)),
//  DCB=(LRECL=80,RECFM=FB)
//CNTLCRDS DD *
//SYSPRINT DD SYSOUT=*
//SYSUDUMP DD SYSOUT=*
 //*****************************************************************
//*** STEP 4     ***************************************************
//*****************************************************************
//RUNRSR0 EXEC  PGM=DFSKRSR0
//SYSUT1   DD DISP=SHR,
// DCB=BUFNO=10,
// DSN=IMSDUMP.OLD02.D1203
//SYSPRINT DD SYSOUT=*,DCB=(LRECL=133,RECFM=FBA)
//REPORT  DD DISP=(NEW,CATLG,CATLG),
//  DSN=USERID.ANALYSIS.KBLA.R.X04173.Y102001,
//  UNIT=SYSDA,SPACE=(TRK,(1,1)),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//LOGDESC  DD DISP=SHR,DSN=*.RUNLGD.LOGDOUT
//DETAIL  DD DISP=(NEW,CATLG,CATLG),
//  DSN=USERID.ANALYSIS.KBLA.D.X04173.Y102001,
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(RECFM=FB,LRECL=100,BLKSIZE=8000)
//REPORT  DD DISP=(NEW,CATLG,CATLG),
//  DSN=USERID.ANALYSIS.KBLA.R.X04173.Y102001,
//  UNIT=SYSDA,SPACE=(TRK,(1,1)),
//  DCB=(LRECL=133,BLKSIZE=6118,RECFM=FBA)
//LOGDESC  DD DISP=SHR,DSN=*.RUNLGD.LOGDOUT
//DETAIL  DD DISP=(NEW,CATLG,CATLG),
//  DSN=USERID.ANALYSIS.KBLA.D.X04173.Y102001,
//  UNIT=SYSDA,
//  SPACE=(CYL,(100,50),RLSE),
//  DCB=(RECFM=FB,LRECL=100,BLKSIZE=8000)
//CNTLCRDS DD *
 SUBTYPE
//SYSUDUMP DD SYSOUT=*
```

Control Statements for DFSKRSR0

Processing for DFSKRSR0 is directed by control statements that are read from the CNTLCRDS file. Control statements are 80-byte fixed length records. Most control statements are optional. The result of omitting a statement is described with each keyword. Comment statements are indicated with an asterisk (*) in column 1. Blank records are ignored. Control statement keywords are coded within the boundaries of columns 1 through 72 and are subject to the following syntax rules:

- Keywords can start in any column.
- Keywords can occur in any order.
- There can be no intervening blanks between keywords indicating a data value and the value itself.
- Multiple keywords are either:
  - Separated by one or more blanks
  - Specified on multiple control statements
- Keywords for which multiple occurrences are allowed must have each occurrence specified on a separate control statement.
- Individual keywords and their associated values cannot span or be continued on multiple control statements.
- Keywords must be in upper case.

Control Keywords for DFSKRSR0

Control statements that can be specified are keywords that indicate:

- Global actions
- Processing options
- Selection criteria

Global Keywords

Global keywords are optional keywords that influence the utility's actions. If they are omitted, no optional action will be performed.

SUBTYPE
Indicates that, in addition to reporting by log record type, the log processing rate data is to be accumulated and reported by subtype within a log record type.

Processing Keywords

Processing keywords are optional keywords that indicate how much of the log is to be processed. If they are omitted, the entire log is processed.

Restrictions:

- STOPLSN=, STOPSTCK=, and PROCESS= are mutually exclusive.
- STARTLSN=, STARTSTCK=, and SKIP= are all mutually exclusive.

INTERVAL=
Specifies a time interval at which the log processing rate should be calculated and reported. It is specified in number of minutes elapsed since either the previous interval or beginning of processing. The INVERVAL= keyword is optional. If omitted, the report data will not be evaluated by time intervals. The format of the INTERVAL= keyword is a 1- to 3-digit number.

Restrictions: None.

PROCESS=
Specifies the number of log records that should be processed prior to utility termination. The PROCESS= keyword is optional. If omitted, all records are processed. The format of the PROCESS= keyword is a 1- to 8-digit number.

SKIP=
Specifies the number of log records that should be skipped before any records are to be processed and included in reports. The SKIP= keyword is optional. If omitted, no records are skipped prior to processing. The format of the SKIP= keyword is a 1- to 8-digit number.

STARTLSN=
Specifies the log sequence number of the first log data set to be processed. An exact match of time is not required. Processing will stop with the first record equal to or greater than the indicated log sequence number. If omitted, processing will start at the beginning of the log. The format of the STARTLSN= keyword is an 8-character hexadecimal value.

STARTSTCK=
Specifies the time of the first log data set to be processed. An exact match of time is not required. Processing begins with the first record equal to or greater than the indicated time. The STARTSTCK= keyword is optional. If omitted, processing starts at the beginning of the log. The format of the STARTSTCK= keyword is of the format yyyydddhhmmss.

STOPLSN=
Specifies the log sequence number of the last log data set to be processed. If omitted, processing will continue until end of log. The format of the STOPLSN= keyword is an 8-character hexadecimal value.

STOPSTCK=
Specifies the time of the last log data set to be processed. An exact match of time is not required. Processing stops with the first record equal to or greater than the indicated time. The STOPSTCK= keyword is optional. If omitted, processing continues until the end of the log. The format of the STOPSTCK= keyword is yyyydddhhmmss.

Selection Criteria Keywords

Selection criteria keywords are optional keywords that indicate which records are to be selected. If they are omitted, all records are processed.

LOGTYPE=
Indicates the log record types that are to be included in the reports. The LOGTYPE= keyword is optional. If omitted, all log record types are reported. Multiple occurrences of the LOGTYPE= keyword are allowed. The format of the LOGTYPE= keyword is a 2-character log type ID.

Restrictions: None.

Return Codes for DFSKRSR0

Code	Meaning
0	Utility successfully completed.
4	Warning messages were issued.
8	Utility terminated before completion.

DETAIL File Layout

Table 56 describes the record layout of the DETAIL file.

Table 56. Layout of the DETAIL File

Data	Position	Length	Format
Log record type	1	3	Hexadecimal
Log record subtype	3	5	Hexadecimal
Range starting time stamp (0yyyyddd0hhmmsst)	3	16	Numeric
Range ending time stamp (0yyyyddd0hhmmsst)	23	16	Numeric
Record count	40	4	Binary
Record length	44	4	Binary
Records per second	48	4	Binary
Bytes per second	52	4	Binary
Record count	56	8	Numeric
Record length	64	5	Numeric
Records per second	69	8	Numeric
Bytes per second	77	8	Numeric
Filler	85	16	Blanks

Log Record Processing Rate Analysis Summary Report Examples

The summary report created by DFSKRSR0 is written to the file identified by the REPORT DD statement in the JCL. “Example 1” and “Example 2” on page 602 show examples of the Log Record Processing Rate Analysis Summary report.

Example 1

In this example:

- One control statement specified that SUBTYPE data should be included in the report.
- The log selected was IMSVS.TESTLOG.
- The time period for this interval was displayed. The time period represented 2379 records.
- Log record processing rate data for all of the log record types and subtypes was displayed. Records per second and Bytes per second are rounded to the nearest whole number.
- The first log record read on the log was also the first record processed on the log (no records were skipped).
- The log sequence number range represented on the log was displayed. Although the log sequence number is actually an 8-byte field, only the last 4 bytes are presented with KBLA.
- One record was read from the CNTLCRDS file.
- No records were skipped.
- A total of 7 342 792 log records were read.
- All 7 342 792 log records were evaluated.
- The entire log was processed as a single interval.

```
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:25   PAGE:        1
* ************************************************************************
*
* CNTLCRDS:  SUBTYPE
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:25   PAGE:        2
* ************************************************************************
*
*
* INPUT LOG DATA SET NAME(S)
* IMSVS.TESTLOG
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:25   PAGE:        3
* ************************************************************************
*
* RATE STATS  (00:07:47.9 - 00:47:27.5)  ELAPSED: 000 00:39:39.6      2379 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
*
*  07       148634        62    348     21742  APPLICATION PGM TERMINATED
*  08       148638        62    112      6997  APPLICATION PGM SCHEDULED
*  09           88         0    336        12  SEQUENTIAL BUFFERING RECORD
*  18         3710         1    359       560  USER PGM ISSUED CHPT CALL
*  27         5465         2     72       166  DATA BASE WAS EXTENDED
*   2701      2733         1     84        96  DATA BASE WAS EXTENDED-PHASE 1
*   2702      2732         1     61        70  DATA BASE WAS EXTENDED-PHASE 2
*  37       150411        63    104      6613  SYNCPOINT PROCESSOR LOG RECORD
*   3730    150411        63    104      6613  SYNCPOINT PROCESSOR LOG RECORD
*  38           54         0    112         2  MSG PUT BACK ON Q. APPL ABEND
*  40         2002         0   1000       841  TOTAL NUMBER OF CHECKPOINT REC
*   4001        11         0    440         2  CHECKPOINT PROCESS START
*   4006       484         0   1000       203  DMB(S) FOLLOW
*   4007      1452         0   1020       623  PSB(S) FOLLOW
*   4030        33         0    774        10  RRE(S) FOLLOW
*   4031        11         0    392         1  SIDX FOLLOW
*   4098        11         0    104         0  CHKPT INFORMATION ENDS HERE
*  41         1834         0    106        81  BATCH OR BMP ISSUED A CHKP
*  42           12         0    600         3  OLDS SWITCH/CHKPT WAS TAKEN
*  43       417365       175     24      4212  STATUS OF CURRENT OLDS D/S
*  45          297         0    529        66  BEGIN-STATISTICS RECORD
*   4500        11         0     52         0  BEGIN-STATISTICS RECORD
*   4504        55         0    144         3  DL/I BUFFER POOL STATISTICS
*   4505        11         0    120         0  VARIABLE STORAGE POOL STATS
*   4506        11         0    144         0  APPLICATION SCHEDULING STATS
*   4507        11         0     76         0  LOGGING STATISTICS
*   4508        66         0    136         3  VSAM BUFFER POOL STATISTICS
*   4509        11         0     48         0  PROGRAM ISOLATION STATISTICS
*   450A        11         0   2148         9  LATCH MANAGEMENT STATISTICS
*   450B        11         0     52         0  SELECTIVE DISPATCHER STATS
*   450C        11         0   3556        16  STORAGE POOL STATISTICS
*   450E        33         0    856        11  FIXED STORAGE POOL STATISTICS
*   450F        11         0   3248        15  DISPATCHER STATISTICS
*   4510        11         0     48         0  RCF MULTI-TCB STATISTICS
*   4521        11         0    172         0  IRLM SUBSYSTEM STATISTICS
*   4522        11         0    484         2  IRLM SYSTEM STATISTICS
*   45FF        11         0     56         0  END OF STATISTICS RECORD
*  47          183         0   1026        78  CHKPT JUST TAKEN.PST(S) LISTED
*  48        49500        20     58      1206  OLDS PADDING RECORD
*  4C            4         0     70         0  A BACKOUT FOR TOKEN WAS DONE
*  50      5887602      2474    185    458622  DB UPDATE RECORD
```

```
*   5050   5727294      2407    184    443813  RECOVERY/BACKOUT DATA
*   5052    160308        67    219     14809  PREVIOUS KSDS UPDATE FAILED
*  56       526637       221     98     21882  EXT SUBSYSTEM SUPPORT RECOVERY
*   5600      1232         0    100        51  EXT SUBSYSTEM SUPPORT RECOVERY
*   5607    150472        63     92      5819  START OF A UNIT-OF-RECOVERY
*   5610    148529        62    104      6493  PHASE 1 SYNCPOINT START
*   5611     75885        31     92      2934  PHASE 1 SYNCPOINT END
*   5612    150467        63    104      6577  PHASE 2 SYNCPOINT END
*   5616        52         0    256         5  START OF PROTECTED UOW
* ********************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:25   PAGE:        4
* ********************************************************************************
*
* RATE STATS  (00:07:47.9 - 00:47:27.5)  ELAPSED: 000 00:39:39.6      2379 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
*  67          356         0    783       117  SYSTEM DIAGNOSTIC LOG RECORD
*   6705         9         0    731         2  TERMINATE THREAD RECORD
*   67FF       347         0    784       114  EXCEPTION CONDITION SNAP
*
* ********************************************************************************
*              LOG RECORD PROCESSING RATE INFORMATION SUMMARY                    *
*
*
* FIRST LSN: 598F405B      LAST LSN: 59FF4B22
* FIRST SELECTED LSN: 598F405B
*
* FIRST LOG RECORD STCK   (UTC): 2004160 0007479
* FIRST SELECTED LOG STCK (UTC): 2004160 0007479
* LAST LOG RECORD STCK    (UTC): 2004160 0047275
*
* ELAPSED TIME ON SELECTED LOG(S):                              000 00:39:39.6
*
*
* TOTAL # OF NON COMMENT CNTLCRDS RECORDS READ    :       1
*
* REQUESTED # OF LOG RECORDS TO BE SKIPPED        :       0
* TOTAL # OF LOG RECORDS SKIPPED                  :       0
*
* TOTAL # OF LOG RECORDS READ                     : 7342792
* TOTAL # OF LOG RECORDS EVALUATED                : 7342792
*
* TOTAL # OF REPORTING INTERVALS                  :       1
*
* ********************************************************************************
```

Example 2

In this example:

- Six control statements were specified:
  - SUBTYPE data included in the report.
  - Log rate analysis is performed at 10-minute analysis intervals.
  - Analysis was requested for X'07', X'08', X'01' and X'03' log records.
- The log selected was IMSVS.TESTLOG.
- Four intervals were displayed:
  - The first three intervals were each 10 minutes (600 seconds) in length.
  - The last interval was for the remaining 579 seconds.
- Log record processing rate data for all of the requested log record types and subtypes was displayed.
- No records were found for the X'01' and X'03' records.

- X'07' and X'08' records are not divided into subtypes.
- The first log record read on the log was also the first record processed on the log (no records were skipped).
- The log sequence number range represented on the log was displayed.
- Six records was read from the CNTLCRDS file.
- No records were skipped.

```
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        1
* ************************************************************************
*
* CNTLCRDS:  SUBTYPE
* CNTLCRDS:  INTERVAL=10
* CNTLCRDS:  LOGTYPE=07
* CNTLCRDS:  LOGTYPE=08
* CNTLCRDS:  LOGTYPE=01
* CNTLCRDS:  LOGTYPE=03
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        2
* ************************************************************************
*
*
* INPUT LOG DATA SET NAME(S)
* IMSVS.TESTLOG
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        3
* ************************************************************************
*
* RATE STATS  (00:07:47.9 - 00:17:47.9)  ELAPSED: 000 00:10:00.0       600 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
*
*  07        48438        80    348     28094  APPLICATION PGM TERMINATED
*  08        48440        80    112      9042  APPLICATION PGM SCHEDULED
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        4
* ************************************************************************
*
* RATE STATS  (00:17:47.9 - 00:27:47.9)  ELAPSED: 000 00:10:00.0       600 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
*
*  07        47609        79    348     27613  APPLICATION PGM TERMINATED
*  08        47631        79    112      8891  APPLICATION PGM SCHEDULED
*
* ************************************************************************
* ************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        5
* ************************************************************************
*
* RATE STATS  (00:27:47.9 - 00:37:47.9)  ELAPSED: 000 00:10:00.0       600 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
```

Rate Analysis Summary Report

```
*
*  07        28168        46    348     16337  APPLICATION PGM TERMINATED
*  08        28134        46    112      5251  APPLICATION PGM SCHEDULED
*
* ************************************************************************************
* ************************************************************************************
* Log Rate Analysis / DFSKRSR0     DATE: 2004/173   TIME: 10:40   PAGE:        6
* ************************************************************************************
*
* RATE STATS  (00:37:47.9 - 00:47:27.5)  ELAPSED: 000 00:09:39.6       579 SECS
*
*  LOG     TOTAL    RECORDS    AVG.   BYTES    LOG RECORD
*  TYPE   RECORDS    /SEC      LEN.   /SEC     DESCRIPTION
*  -----  --------  --------  -----  --------  ------------------------------
*
*  07        24419        42    348     14676  APPLICATION PGM TERMINATED
*  08        24433        42    112      4726  APPLICATION PGM SCHEDULED
*
* ************************************************************************************
*              LOG RECORD PROCESSING RATE INFORMATION SUMMARY
*
*
* FIRST LSN: 598F405B      LAST LSN: 59FF4B22
* FIRST SELECTED LSN: 598F405B
*
* FIRST LOG RECORD STCK   (UTC): 2004160 0007479
* FIRST SELECTED LOG STCK (UTC): 2004160 0007479
* LAST LOG RECORD STCK    (UTC): 2004160 0047275
*
* ELAPSED TIME ON SELECTED LOG(S):                            000 00:39:39.6
*
*
* TOTAL # OF NON COMMENT CNTLCRDS RECORDS READ    :       6
*
* REQUESTED # OF LOG RECORDS TO BE SKIPPED        :       0
* TOTAL # OF LOG RECORDS SKIPPED                  :       0
*
* TOTAL # OF LOG RECORDS READ                     : 7342792
* TOTAL # OF LOG RECORDS EVALUATED                : 7342792
*
* TOTAL # OF LOG RECORD TYPES SELECTED            :       4
*
* TOTAL # OF REPORTING INTERVALS                  :       4
*
* ************************************************************************************
```

Part 7. Appendixes

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Bibliography

This bibliography lists all of the information in the IMS Version 9 library.

HLASM MVS & VM Programmer's Guide, SC26-4941

z/OS DFSMS Access Method Services for Catalogs, SC26-7394

z/OS DFSMSdfp Utilities, SC26-7414

z/OS MVS Interactive Problem Control System (IPCS) User's Guide, SA22-7596

z/OS MVS Program Management: User's Guide and Reference, SA22-7643

z/OS: UNIX System Services Command Reference, SA22-7802

z/OS: UNIX System Services User's Guide, SA22-7801

IMS Version 9 Library

Title	Acronym	Order number
IMS Version 9: Administration Guide: Database Manager	ADB	SC18-7806
IMS Version 9: Administration Guide: System	AS	SC18-7807
IMS Version 9: Administration Guide: Transaction Manager	ATM	SC18-7808
IMS Version 9: Application Programming: Database Manager	APDB	SC18-7809
IMS Version 9: Application Programming: Design Guide	APDG	SC18-7810
IMS Version 9: Application Programming: EXEC DLI Commands for CICS and IMS	APCICS	SC18-7811
IMS Version 9: Application Programming: Transaction Manager	APTM	SC18-7812
IMS Version 9: Base Primitive Environment Guide and Reference	BPE	SC18-7813
IMS Version 9: Command Reference	CR	SC18-7814
IMS Version 9: Common Queue Server Guide and Reference	CQS	SC18-7815
IMS Version 9: Common Service Layer Guide and Reference	CSL	SC18-7816
IMS Version 9: Customization Guide	CG	SC18-7817
IMS Version 9: Database Recovery Control (DBRC) Guide and Reference	DBRC	SC18-7818
IMS Version 9: Diagnosis Guide and Reference	DGR	LY37-3203
IMS Version 9: Failure Analysis Structure Tables (FAST) for Dump Analysis	FAST	LY37-3204
IMS Version 9: IMS Connect Guide and Reference	CT	SC18-9287
IMS Version 9: IMS Java Guide and Reference	JGR	SC18-7821
IMS Version 9: Installation Volume 1: Installation Verification	IIV	GC18-7822
IMS Version 9: Installation Volume 2: System Definition and Tailoring	ISDT	GC18-7823
IMS Version 9: Master Index and Glossary	MIG	SC18-7826
IMS Version 9: Messages and Codes, Volume 1	MC1	GC18-7827
IMS Version 9: Messages and Codes, Volume 2	MC2	GC18-7828
IMS Version 9: Open Transaction Manager Access Guide and Reference	OTMA	SC18-7829
IMS Version 9: Operations Guide	OG	SC18-7830
IMS Version 9: Release Planning Guide	RPG	GC17-7831
IMS Version 9: Summary of Operator Commands	SOC	SC18-7832
IMS Version 9: Utilities Reference: Database and Transaction Manager	URDBTM	SC18-7833
IMS Version 9: Utilities Reference: System	URS	SC18-7834

Supplementary Publications

Title	Order number
IMS Connector for Java 2.2.2 and 9.1.0.1 Online Documentation for WebSphere Studio Application Developer Integration Edition 5.1.1	SC09-7869
IMS Version 9 Fact Sheet	GC18-7697
IMS Version 9: Licensed Program Specifications	GC18-7825

Publication Collections

Title	Format	Order number
IMS Version 9 Softcopy Library	CD	LK3T-7213
IMS Favorites	CD	LK3T-7144
Licensed Bill of Forms (LBOF): IMS Version 9 Hardcopy and Softcopy Library	Hardcopy and CD	LBOF-7789
Unlicensed Bill of Forms (SBOF): IMS Version 9 Unlicensed Hardcopy Library	Hardcopy	SBOF-7790
OS/390 Collection	CD	SK2T-6700
z/OS Software Products Collection	CD	SK3T-4270
z/OS and Software Products DVD Collection	DVD	SK3T-4271

Accessibility Titles Cited in This Library

Title	Order number
z/OS V1R1.0 TSO Primer	SA22-7787
z/OS V1R5.0 TSO/E User's Guide	SA22-7794
z/OS V1R5.0 ISPF User's Guide, Volume 1	SC34-4822

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