

DBARS

Db2 Access Recording Services

User's Guide

Version 4.4

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1 Product Description

Many corporations maintain sensitive or confidential data that are vital to corporate operations. In today's distributed IT environments, these data need special protection. As the initial security measure, Db2 privileges are granted to authorized users who are allowed to access these data. As a further measure, all access to sensitive data should be recorded, to verify that accesses are made for legitimate reasons and not for fun, curiosity or dishonest motives.

Today, there is a growing concern (and legislation) about data privacy. Databases often contain confidential information about individuals. This information has been entrusted by the individual to the corporation, in the expectation that the information will be handled with respect to personal privacy. Legislation may state that companies owning personal information, implement procedures to ensure that personal data are accessed by legitimate sources only. Legislation may also impose that accesses to confidential information can be retraced whenever needed.

Once Db2 privileges have been granted to a user, the user has access to the entire table. For reasons of security and privacy, it is necessary to control data access at the table-row level. It is therefore advisable to maintain an access log, either by application programming or by means of a system tool. The access log should record which data have been accessed, by whom and when. The log will be a valuable source of information for auditors or security officers.

1.1 Db2 Auditing Facilities

Sensitive data are normally stored in Db2 tables created with the AUDIT clause of the CREATE TABLE statement. A Db2 audit trace can be activated to verify that only authorized users access auditable tables and to record the SQL statements that access these tables. Finally, Db2 log analysis can be used to view the actual modifications to the data.

However, these Db2 facilities are not sufficient to fully record all access to sensitive data, for the following reasons:

- The audit trace records only the first read or write SQL statement in a logical unit of work.
- The trace records do not provide the contents of the input variables submitted with the SQL statement. Without this information, access recording is incomplete.
- Db2 auditing requires that an auditing trace be enabled. If many tables are audited or intensely used, the operating cost of tracing may be excessive.

1.2 Facilities provided by DBARS

Db2 Access Recording Services - "**DBARS**" - is a product developed by Software Product Research.

- DBARS records all accesses to sensitive data in auditable Db2 tables, by recording the SQL statements that perform the access. DBARS also records Db2 utility executions and Db2 commands.
- DBARS will record access to:
 - the Db2 tables specified in the AUDITNAMES section of the DBARS startup parameters
 - **all** Db2 tables when the ALLTABLES option is specified at DBARS startup
 - when none of the above is specified, the Db2 tables created with the AUDIT CHANGE or AUDIT ALL attribute
- DBARS records all input variables ("hostvariables") associated with the SQL statement.
- DBARS stores the intercepted SQL statement into the DBARS **Recorder**.
- DBARS provides a powerful utility to scan the Recorder for recorded events.
- DBARS has its own interface to Db2 and does not depend on Db2 tracing. As a result, recording overhead will be minimal.
- DBARS provides following additional functions, when requested by the installation:
 - Keep recorded audit events for an unlimited period of time using automatic Recorder archiving.
 - Issue alerts for questionable SQL statements.
 - Block Db2 access for questionable SQL statements.
 - Maintain an "exceptions" Db2 table for questionable SQL statements.
 - Send exceptions to the Windows Event Log.
 - Provide data masking.
 - Implement SQL reduction for long sequences of structurally identical SQL statements.
 - Provide the Centralized Recorder Service allowing to share the DBARS Recorder between individual DBARS instances.
 - Integrate with external security systems, using FTP or TCP/IP sockets.

1.3 The Recorder

For each access to an audited table, DBARS inserts following data into the DBARS **Recorder**:

- The **context** of statement execution:
 - the date and time of access
 - the name of the Db2 application server accessed
 - the name of the Db2 application requester (identical to the application server for local access)
 - the Db2 and z/OS userid
 - the correlation ID (e.g. the z/OS job name for batch access)
 - the type of connection (e.g. batch, CICS)
 - the type of access (dynamic or static)
 - the LUW_id
 - the external application name for distributed access
 - the workstation name for distributed access
 - the name of the program used for access
 - the number of rows modified by the statement
 - the statement's SQLCODE (indicating successful or failing access)
- The **text of the SQL statement** executed, with all input variables ("host variables") in the statement replaced by their contents. ¹

At the choice of the user, the Recorder is a Db2 table, a VSAM ESDS cluster or a sequential file (BSAM dataset).

Recorder Considerations

- When defining a VSAM ESDS Recorder during product installation, the supplied jobstream will also define Recorder Index clusters. These KSDS clusters are provided to allow faster scan of the Recorder. The Recorder Indexes are on date and time. A Recorder Index record is written every hour with related positioning information.
- A VSAM or a BSAM Recorder can be "exported" to a Db2 Recorder using the archive program. If exporting occurs frequently, the advantages of both Recorder options can be combined. For more details, read section 16.8.
- The sequential file option provides the best performance and flexibility. The option should be chosen when intensive access recording is performed.

¹ When VARCHAR variables are replaced, the length of the replacement is limited to 128 characters. Should the application specify an invalid length for the VARCHAR, the variable will be displayed as ???.

1.4 Inspecting the Recorder

The **Recorder Scan** utility searches the Recorder for specific access events. The user may supply following search criteria:

- One or more columns of the Recorder.
- Table column names used in the recorded SQL statement. This will report all SQL statements that reference the named table column.
- Table column names with a specified value. This will report all statements that reference the table column with the specified value. This option will report all recorded access for a given table "key".

The Recorder Scan program includes following additional facilities:

- The search values specified for the recorder table columns may contain Db2 expressions. For example: **Program Name LIKE DSQ%**
- The program can be used to scan the archive result table, described in the paragraph "Archiving the Recorder".
- The search arguments supplied by the user are saved in a Db2 table and may be recalled in a later scan session. The USERPARMS table saves up to 32 sets of search arguments.

1.5 Access Summary Report

The Access Summary program accepts the same search criteria as the Recorder scan. The program provides an hierarchical view of recorded access events.

- Typically, access summary is requested to display, for a given table, the **list of all users** that have accessed the table in a defined period of time.
- For a designated user in the user list, a **program list** may be requested, to list all programs by which that user has accessed the table.
- In the program list, a **statement list** may be requested for a selected program. The list will show the program's SQL statements, executed by the user against the Db2 table.

1.6 Archiving the Recorder

The DBARS archiving function transfers the Recorder to a sequential disk or tape dataset, so that recorded information can be kept for a longer period of time.

DBARS supplies a utility to scan an archived Recorder using the search criteria, described above. At the choice of the user, the archive scan produces a printed report or a result Db2 table. The latter table can be used as input for an interactive Recorder scan.

1.7 Customizing DBARS

- When the Recorder has been defined as a Db2 table, it can be processed as such by customer procedures. When the Recorder is a VSAM cluster or a sequential file, the Recorder scan can be used to transfer the Recorder entries to a Db2 table.
- An installation may provide a user exit that will be invoked whenever an access is stored in the Recorder. The exit is written in REXX and receives all the Recorder columns as its input arguments.

1.8 Access Exception Reporting

The Access Exception Reporting facility is designed for implementation within a DBARS User Exit, in order to detect and report unusual data access events. For more details see "Reporting Access Exceptions").

1.9 The DBARSGUI Facility

The facility allows a Windows workstation to scan the DBARS Recorder. DBARSGUI is a client-server application, where the server is implemented by the DBARSGUI program executing in a z/OS address space. The client application consists of a number of Java classes.

DBARSGUI is self-contained: it has no special software prerequisites.

2 DBARS Setup

How to install DBARS is described in our manual "DBARS Installation Guide".

2.1 List of invocable DBARS components

Online TSO components

Report from a BSAM Recorder	DBARSRRS
Report from a VSAM Recorder	DBARSRRX
Report from a Db2 Recorder	DBARSIR
Report from the DBARS Exception table	DBARSXR

Batch components

Start the DBARS auditing environment	DBARS
Archive the DBARS Recorder manually	DBARSA
Report from a DBARS Archive	DBARSAR
Automated Recorder archiving	DBARSARC
Bind DBARS components	DBARSBND
Create DBARS Archive as a Db2 table	DBARSCAT
Start Centralized Recorder Service	DBARSCRS
Define the DBARS Recorder as a BSAM dataset	DBARSCSR
FTP the DBARS Recorder	DBARSFTP
Link the DBARS components	DBARSLNK
DBARS exception logging to Windows event log	DBARSLOG
Define the DBARS Recorder as a VSAM cluster	DBARSREC
Report from the DBARS Recorder	DBARSRR
Create the DBARS Db2 tables	DBARSTAB

Windows workstation component

Start the DBARS Graphical User Interface	DBARSGUI
--	----------

2.2 Db2 Privileges for DBARS components

Component	Function	Execute Privilege on	Table Privileges
DBARSA	Archive DBARS Recorder	DBARSA	INSERT privilege on output table if archiving to a Db2 table
DBARSAR	Batch reporting from DBARS Archive	DBARSAR	INSERT privilege on output table if report output to a Db2 table
DBARSGIM	DBARS Recorder reporting from the DBARSGUI interface	DBARSGIM DBARSIR DBARSRRRI DBARSXR	SELECT privilege on DBARS.RECORDER DBARS.EXCEPTIONS
DBARSIR	Online reporting from a Db2 DBARS Recorder	DBARSIR	SELECT privilege on DBARS.RECORDER
DBARSRR	Batch reporting from DBARS Recorder	DBARSRR	INSERT privilege on output table if report output to a Db2 table
DBARSRRRI	Online reporting from a VSAM/BSAM DBARS Recorder	DBARSRRRI	None
DBARSW	Write to DBARS Recorder	DBARS DBARSW	None
DBARSXR	Exception reporting	DBARSXR	SELECT privilege DBARS.EXCEPTIONS

2.3 DBARS startup parameters

By default, DBARS startup parameters are specified in the **EXECPARM** member of the **DBARS.JCLLIB** library.

If the startup parameters are stored elsewhere, specify the membername and eventually the libraryname on the PARM operand of the EXEC DBARS statement, as follows:

```
PARM='membername'  
or:  
PARM='libraryname(membername)'
```

In the PARM='membername' case, the libraryname defaults to DBARS.JCLLIB.

EXECPARM syntax rules:

- An EXECPARM statement should be coded on a single line and should not exceed 80 characters.
- Continuation lines are not allowed, as there is no need for.
- Most startup parameters have default values. If these defaults are acceptable, there is no need to specify the parameter at all.
- Comments are allowed in the EXECPARM dataset. A line starting with an asterisk is treated as a comment. Comments may also follow the statement parameters. In this case the comment should be enclosed by /* and */.

For example: DB2SYS xxxx /* Db2 subsystem to audit */

2.4 Index of DBARS startup parameters

Parameter	Description	See page
ALERT_PROC	User exit for alert	12
ALLTABLES	Audits all tables	12
ARCHIVE_PROC	Automated archive proc	12
AUDITNAMES	Tablenames to audit	13
CRS	Centralized recorder service	13
DB2_ADDRSPACE	Name of DBM1 address space	14
DB2_SUBSYS	Name of Db2 subsystem	14
EXCLUDE	Tables to exclude from audit	14
EXIT	User exit name	14
EXITMOD	Compiled user exit name	15
IGNORE	Ignore users, programs or jobs	15
INCLUDE	Include named users	16
NOINDEX	No index on DBARS recorder	16
OPTIONS	Auditing options	17
PROGCACHE	Size of cached programs	17
Q2_SIZE	Size of audit queue	18
RECORD	Recording options	18
RECORDER_LOC	Location of shared VSAM recorder	19
RULES	Alerting and blocking rules	19
SAM_PREFIX	Prefix of BSAM recorder	19
SCAN	Scan interval of audit queue	19
SEQREC	Requests a VSAM recorder	19
VSAM_SHARED	Requests a shared VSAM recorder	19

2.4.1 **ALERT_PROC Datasetname(Membername)**

If DBARS should invoke a user exit for an ALERTed access, specify the library and membername of the REXX program.

For details about writing DBARS user exits, see section "Writing an Alert Exit" [below](#).

If ALERT_PROC and EXIT specified, both members should reside in the same library.

Default: No exit is invoked.

2.4.2 **ALLTABLES [CHANGE]**

Requests that DBARS records the accesses to all Db2 tables. When ALLTABLES CHANGE is specified, only update accesses will be recorded. Otherwise, all access, including SELECT, is recorded.

For reasons of performance, this option should be used **with caution**.

ALLTABLES may be followed by one or more EXCLUDE statements. The EXCLUDE statement is described later in this section.

When ALLTABLES is not specified, recording will be done only for the Db2 tables defined with the AUDIT CHANGE or AUDIT ALL attribute or for the tables specified after **AUDITNAMES**.

2.4.3 **ARCHIVE_PROC procedurename**

When a SWITCH_REC command is supplied or when a no-more-space condition is detected for the Recorder, DBARS automatically switches to the Auxiliary Recorder.

If the ARCHIVE_PROC statement has been provided, the named procedure will be started before switching to the alternate recorder. If no archiving occurs, all data on the primary Recorder will be lost.

For more information, refer to [Automated Recorder Archiving](#).

2.4.4 **ARCHIVE AFTER nnn**

The ARCHIVE AFTER statement requests automatic archiving when **nnn** blocks have been written to the Recorder. A Recorder block typically contains about 50 logical records. Each logical record is the notation of a Db2 access event.

The ARCHIVE AFTER statement allows to automatically archive the Recorder when the Recorder is x percent filled.

2.4.5 **AUDITNAMES**

This optional statement starts the list of tablenamees to be recorded. It should be the last statement in the parameter dataset and be followed by a tablename list. See also [Specifying the tables to be recorded](#).

Each line in the tablename list has the format:

owner[%].tablename[%] [CHANGE] [COUNT_ROWS]

A generic owner or tablename may be specified by appending a % sign to the end of the generic name.

If the **CHANGE** keyword is specified, only write access will be recorded for the designated tables: SELECT statements will not be recorded. If CHANGE is omitted, all access, including SELECT, will be recorded.

If the **COUNT_ROWS** keyword is specified, DBARS will record the number of rows fetched from the table. Each fetch access with its rowcount is presented to the DBARS access blocking facility, if that facility has been enabled.

AUDITNAMES example: AUDITNAMES
 DZVO.EMPLOYEEES
 CUSTOMER.STATS CHANGE
 ACCOUNT.ACT%

2.4.6 **CRS <IP_address:port>**

Requests that this DBARS instance will communicate with the Centralized Recorder Service using TCP/IP sockets.

Specify the IP address of the z/OS system that runs the CRS service and the port number on which CRS is listening.

If CRS is specified the SEQREC or SAM_PREFIX statements should be omitted.

For details on the CRS feature, please refer to chapter [9](#) of this manual.

2.4.7 **CRS <jobname>**

Requests that this DBARS instance should directly store its data into the queue of the Centralized Recorder Service running on <jobname>.

This option can only be used for DBARS instances running under the same z/OS system as the CRS address space.

If CRS is specified the SEQREC or SAM_PREFIX statements should be omitted.

For details on the CRS feature, please refer to chapter [9](#) of this manual.

2.4.8 **DB2_ADDRSPACE nnnnnnnn**

Specify **nnnnnnnn** as the name of the Db2 Database Address Space.

Default: <Db2_subsystemname>DBM1

2.4.9 **DB2_SUBSYS nnnn**

Specify **nnnn** as the name of the Db2 subsystem where DBARS should be installed.

Default: the subsystem name found in DSNHDECP.

2.4.10 **DYNOONLY**

When this option is specified, only dynamic SQL is recorded.

Warning

This option should be specified only on systems where DBARS runs as an SQL recorder. If DBARS is used as a security product, the DYNOONLY option should not be specified.

2.4.11 **EXCLUDE owner.tablename**

The EXCLUDE statement should be specified only when using the ALLTABLES option. It specifies the owner and tablename(s) to be removed from the previous ALLTABLES list. A generic tablename specification is allowed by terminating the name with a % sign.

For example:

```
ALLTABLES  
EXCLUDE SYSIBM.%  
EXCLUDE Q.ORG
```

2.4.12 **EXIT Datasetname(Membername)**

If DBARS should invoke a user exit for every recorded access, specify the library and membername of the REXX program.

For details about writing DBARS user exits, see section [Writing a DBARS User Exit](#).

If EXIT and ALERT_PROC specified, both members should reside in the same library.

Default: No exit is invoked.

2.4.13 EXITMOD modulename [parameters]

If DBARS should invoke a **compiled** user exit for every recorded access, specify the load module name of the exit. The load module should reside in a z/OS STEPLIB or JOBLIB.

Optionally, up to 8 parameter strings can be specified on the EXITMOD statement. The exit will receive the address of each parameter in its parameterlist.

For details about writing an EXITMOD, see chapter [22](#)

Default: No exit is invoked.

2.4.14 IGNORE

The IGNORE statement allows to bypass access recording for defined Db2 users, programs or jobs.

The syntax of the IGNORE statement is as follows:

```
IGNORE [JOB nnn] [USER nnn] [PROGRAM nnn]
```

```
IGNORE JOB      ignore all accesses from the named z/OS job
IGNORE USER    ignore all accesses by the named Db2 user
IGNORE PROGRAM ignore all accesses from the named Db2 program
```

Notes:

Names appearing on the IGNORE can be generic by providing a trailing %.
For example: IGNORE JOB REORG%.

If multiple ignore criteria appear on the same IGNORE statement, access will be ignored only when all the criteria are true.

For example: IGNORE PROGRAM ADBMAIN USER DBADM will ignore accesses by the ADBMAIN program, only when that program is executed by Db2 userid DBADM.

2.4.15 **INCLUDE**

The INCLUDE statement defines the Db2 users, subject to access auditing. If no INCLUDE statements are specified, all Db2 users will be audited.

The syntax of the statement is as follows:

```
INCLUDE USER nnnnnnnn
```

Notes:

Names appearing on the INCLUDE statement can be generic by providing a trailing %. For example: INCLUDE USER ACCT%.

An unlimited number of INCLUDE statements can be supplied.

2.4.16 **NOINDEX**

When the DBARS Recorder is a VSAM ESDS, an indexing KSDS cluster is maintained by the DBARS Writer task. The purpose of this index is to speed up the DBARS Recorder Scan program. If an external reporting system is used instead of DBARS reporting, the NOINDEX statement will provide increased performance in the DBARS Writer

2.4.17 **OPTIONS [NODDF] [NOMASK] [XML] [REDUCE_SQL]**

OPTION NODDF

Inhibits recording of SQL accesses from the DDF environment.

OPTION NOMASK

Turns the DBARS data masking facility off. By default, DBARS masks the data values in the recorded SQL statements.

OPTION XML

Requests that the DBARS Writer store the audit records in XML format, for transmission to an external security system.

OPTION REDUCE_SQL

Requests that long sequences of identical SQL statements be reduced to a single statement in the DBARS Recorder. For details on the SQL reduction feature, please refer to chapter [8](#) of this manual.

2.4.18 **PROGCACHE n**

For static SQL statements longer than 4K, DBARS must retrieve the statement text from SYSIBM.SYSSTMT. To avoid repetitive catalog access for the same statement, a program cache is maintained for the most recently retrieved statements.

The PROGCACHE parameter specifies the maximum number of entries in the cache. If that value is exceeded, the oldest cache entries are removed. The PROGCACHE value specified should be a power of 2. If necessary, DBARS will round the specification to the next power of 2.

Default size of the program cache: 4096

2.4.19 **Q2_SIZE n**

Before being inserted into the Recorder table, intercepted SQL statements are inserted into a queue (Q2) owned by the DBARS address space and shared by the DBARS Initiator in the Db2 DBM1 address space.

Q2 is a 64-bit object, residing above the 2 Gigabyte bar. The queue consists of a number of chained 128 K pages, whose total size equals Q2_SIZE. Q2 pages are not accessed until data is stored into them. Hence, there is no performance penalty in requesting a large Q2, if the pages in the higher part of the queue are never used.

Specify the size of Q2 in Megabytes.

Default: 1024 (which results in an 1 GB queue)

2.4.20 **RECORD [DDL] [BIND] [UTIL] [CMND]**

RECORD DDL

Requests DBARS to record DDL requests submitted to Db2. When omitted, DBARS will record DML requests only.

RECORD BIND

Requests DBARS to record BIND requests submitted to Db2.

RECORD UTIL

Requests DBARS to record Db2 utility runs.

RECORD CMND

Requests DBARS to record submitted Db2 commands.

Notes:

RECORD BIND, RECORD UTIL and RECORD CMND require the MONITOR1 privilege for the userid executing the DBARS program in the DBARS address space, since these requests are recorded using an IFI trace.

2.4.21 **RECORDER_LOC nnnn**

If DBARS is active in multiple Db2 systems, the DBARS Writer can be requested to store the intercepted SQL statements into a centralized Recorder, if the latter is a Db2 table.

The RECORDER_LOC statement provides the name of the Db2 system that holds the centralized Recorder.

Default: current Db2 system

For more information about Recorder sharing (Db2 and VSAM), please refer to **Shared Recorder Considerations**. A sequential Recorder cannot be shared.

2.4.22 **RULES membername**

If DBARS should block Db2 access requests, specify the name of the member that contains the rules for blocking SQL statements. The member should be in the same z/OS library as the DBARS startup member.

For details about DBARS blocking, please read the Chapter 5 .

2.4.23 **SAM_PREFIX nnnnnnnn**

Specify SAM_PREFIX if sequential (BSAM) datasets should be used for the DBARS Recorders. Replace nnnnnnnnn with one or more dataset qualifiers of your choice. The length of SAM_PREFIX should not exceed 32.

The name of the BSAM Recorder will start with SAM_PREFIX, followed by 'RECORDER.SA' for the primary Recorder and 'RECORDER.SB' for the secondary Recorder.

With SAM_PREFIX **TEST.DBARS** the Recorders will be named: TEST.DBARS.RECORDER.SA and TEST.DBARS.RECORDER.SB.

2.4.24 **SCAN n**

The DBARS main task polls Q2 for new recordings at a defined time interval. The SCAN parameter specifies this interval in 1/100 seconds.

Default = 100 (1 second)

2.4.25 **SEQREC**

Specify SEQREC only when access recording should be done to a VSAM Recorder, which should have been defined previously using the DBARSREC job.

2.4.26 **VSAM_SHARED**

Specify this option when using a VSAM Recorder defined with SHAREOPTIONS(4,3).

2.5 Setup of the DBARS output dataset

The Db2 accesses intercepted by DBARS are stored into the DBARS **Recorder** dataset. The Recorder dataset can be setup as:

- **VSAM cluster**

The DBARSREC installation job creates a VSAM ESDS cluster to contain the audit data and a KSDS index cluster. The index cluster allows to rapidly position the ESDS during online Recorder scan.

A VSAM Recorder is the recommended setup. It is activated using the **SEQREC** startup parameter.

- **Sequential BSAM dataset**

The DBARSCSR installation program creates a flat file with the BSAM organization, to contain the audit data. It is activated using the **SAM_PREFIX** startup parameter.

- **Centralized Recorder**

The Centralized Recorder facility allows to share a DBARS Recorder between multiple address spaces or LPARs. The facility is activated using the **CSR** startup parameter.

- **User processing**

The **EXIT** startup parameter may designate a user written exit program that will process the recorded data. In this case DBARS does not write to an output dataset.

- **Db2 table**

When none of the above options have been selected, DBARS will record into the Db2 table **DBARS.RECORDER**. This table is created during DBARS installation. This option should be selected on lightly loaded Db2 systems only.

Note

When the Recorder is installed, two datasets are actually created: the primary and the alternate Recorder. When the primary Recorder is being archived, recording continues on the alternate Recorder.

The primary and alternate Recorder are used in a flip-flop manner.

3 Operating DBARS

3.1 Specifying the tables to be recorded

- By coding the names of the tables following the **AUDITNAMES** statement in the startup parameter dataset. **This is the preferred method for designating recordable tables.**
- By coding ALLTABLES in the startup parameters. This will record accesses to all Db2 tables. The ALLTABLES option should be used with caution, due to the processing overhead. The ALLTABLES option may be followed by a number of EXCLUDE statements.
- By creating or altering a table with the AUDIT ALL or AUDIT CHANGE clause. This method creates plan-to-table dependencies and may cause rebind when the audit table column is altered. In this case DBARS uses the SYSTABLES.AUDIT column only to determine the auditable tables. Db2 audit tracing is not used.

3.2 Recording a newly created table

When a new table should be recorded after creation, following rules apply:

- The RECORD_DDL start option should be in effect.
- When the CREATE TABLE statement specifies the AUDIT clause, the new table is automatically inserted in the DBARS table list.
- When the ALLTABLES option is in effect, the new table is automatically inserted in the DBARS table list.
- When AUDITNAMES is in effect, the new table is automatically inserted in the DBARS table list, if the new tablename meets a [generic] name specification in the AUDITNAMES table list.

3.3 Recording row fetching

When the COUNT_ROWS option is specified for a table in the startup AUDITNAMES section, DBARS will record the number of rows fetched from the table. The facility is intended to be used in conjunction with a DBARS user exit.

3.4 Initiating DBARS as a started task

- The sample JCL (member DBARS.JCLLIB.DBARS) can be a JOB (located in a member of a data set defined in the IEFJOBS or IEFPSI concatenation of master JCL) or a procedure (located in a subsystem procedure library, for example, SYS1.PROCLIB).
- The REGION parameter on the JOB or EXEC statement should be coded as REGION=0M.
- Please note that the RECORDA, RECORDAX,RECORDB and RECORDBX DD statements present in member DBARS.JCLLIB.DBARS are not needed when the Recorder has been defined as a Db2 table or as a sequential dataset.
- Issue the RACF commands to assign privileges to the started task:

```
RDEFINE STARTED DBARS.DBARS STDATA(USER(yyyy) GROUP(yyy))  
SETROPTS RACLIST(STARTED) REFRESH
```
- Issue a START DBARS or insert the START command into the z/OS startup procedure.

3.5 Initiating DBARS using JCL

Submit the source JCL (member DBARSJ in DBARS.JCLLIB) to JES. Please note that the RECORDA, RECORDAX,RECORDB and RECORDBX DD statements are not needed when the Recorder has been defined as a Db2 table or as a sequential dataset.

The REGION parameter on the JOB or EXEC statement should be coded as REGION=0M.

3.6 Implicit connection considerations

DBARS does not issue explicit connect but assumes that its first SQL statement will implicitly connect to the intended Db2 subsystem. Implicit connections use the default subsystem name specified in the module DSNHDECP. If the default DSNHDECP is not pointing to the desired Db2 subsystem, specify the correct library at the beginning of the STEPLIB or JOBLIB concatenation.

3.7 DBARS Commands

DBARS commands are entered on the z/OS console using the **MODIFY** command (which can be abbreviated to **F**), for example:

```
MODIFY <DBARS_address_space>,STATS
```

or

```
F <DBARS_address_space>,STATS
```

Following commands are available:

AUDITTAB

Displays the list of Db2 tables that are currently recorded by DBARS.

EXECPARMS

Shows the contents of the active startup parameter dataset.

LICENSE

Displays information from the DBARS license key on the console.

RECSTATS

Shows statistical information about the DBARS Recorder VSAM cluster using messages DBARSM14I through DBARSM18I. See Messages issued by the DBARS Queue Manager for details.

REFRESH

Rebuilds the list of tables to be recorded by DBARS. Please note that this command may take a considerable time to complete. It may also cause contention on the Db2 catalogs.

Since the creation of Db2 objects is automatically intercepted by DBARS, use of this command should be exceptional. See "Recording a newly created table".

REFRESH_REDUCE

Rebuilds the list of parameters that control the reduction of SQL statements, by updating the REDUCEP dataset. For more details, refer to chapter [8](#) of this manual.

RELOAD_RULES

If DBARS blocking or alerting is active, the command will load the latest version of the rules from the library member.

RELOAD_UX

If a DBARS user exit is active and changes have been made to the exit coding, the RELOAD_UX command can be used to activate the new version of the exit. If the command is not used, the latest exit coding will be loaded during the next start of DBARS.

STATS

Shows the DBARS queuing statistics, using messages DBARSM03I through DBARSM10I. See Messages issued by the DBARS Queue Manager.

STOP

Terminates DBARS when all recorded access events have been written to the Recorder table.

If the RECORD CMND option has been specified, DBARS will automatically terminate when the Db2 subsystem is stopped.

SWITCH_REC

When the Recorder is a sequential dataset or a VSAM cluster, the command switches between the primary and secondary Recorder in a flip-flop manner. If the primary Recorder is active, switching to the secondary Recorder occurs and vice-versa.

When the Recorder is a Db2 table, the command switches between the DBARS.RECORDER and the DBARS.AUX_RECORDER tables.

Note that a Recorder full condition automatically switches Recorders and schedules a DBARS archive procedure, if one has been defined.

Automated archiving will automatically switch Recorders. See [Automated Recorder Archiving](#).

The command is mainly intended for use by the DBARS archiving procedures. There is usually no reason to manually submit this command.

The following commands are used for problem determination and should be entered only when requested by SPR software support.

- TRACE
- ITRACE
- PTRACE

3.8 Terminating DBARS

On the z/OS console enter the command **MODIFY DBARS,STOP** or the z/OS STOP command.

If Db2 command recording has been enabled, using the **RECORD CMND** statement in the DBARS startup member, DBARS will automatically stop when the Db2 subsystem terminates.

3.9 Operational Considerations

- The DBARS components:
 - The **master task** (DBARS): conducts the DBARS initiation and termination processes and provides an operator command interface.
 - The **Db2 interface task** (DBARSI): intercepts and queues all SQL statements executed into a storage queue. DBARSI executes in the Db2 DBM1 address space.
 - The **writer task** (DBARSW): inserts the SQL statements queued from the storage queue into the Recorder table or cluster.

The intercepted SQL statements are transmitted through the different layers of the DBARS software using the above mentioned queue (Q2):

- The DBARSI component stores the intercepted SQL statements into Q2, which is a 64-bit object owned by the DBARS address space.
 - The DBARS Writer stores the Q2 records into the Recorder. The Writer executes in the DBARS address space.
- The execution priority assigned to the DBARS address space should allow fast retrieval of the buffers built by DBARSI in Q2. This is especially true when a large number of SQL requests will be recorded.
 - Buffers acquired by DBARS have storage key 7. This protects DBARS data from access by application processes, which execute in key 8.
 - Initiating DBARS as a started task during z/OS IPL is the recommended method for starting DBARS, as it ensures that all accesses to audited tables will be recorded. When started before Db2 is active, DBARS will wait until Db2 is up.
 - DBARS must be initiated in all Db2 subsystems where access to audited tables should be recorded.
 - DBARS records all SELECT INTO, INSERT, UPDATE and DELETE statements. For cursor-based SELECT, only the OPEN of the cursor is recorded.
 - SQL statements executed by means of the DSNUTIL EXEC SQL facility are recorded.

3.10 DBARS Recording Considerations

When the Recorder has been defined as a Db2 table, the following applies:

The DBARS Writer inserts recorded SQL statements into the primary RECORDER table. When a recoverable error, such as insufficient space, is detected, diagnostic information is written to the console and an automatic switch to the auxiliary recorder table AUX_RECORDER, is performed. This allows to clear the error situation on the primary recorder, at which time the primary recorder should be re-activated using the SWITCH_REC command, described in the section of this manual.

When the Recorder has been defined as a VSAM cluster or a sequential dataset, the following applies:

Two Recorders have been defined at product installation (RECORDER.A and RECORDER.B). When one of the Recorders has no more space, an automatic switch is done to the alternate Recorder.

When Recorder switching has occurred, the now inactive Recorder should be archived, preferably using automated archiving. (See Automated Recorder Archiving) If the inactive Recorder is not archived, its contents will be lost when performing the next switch.

When a Db2 request has been blocked or alerted by DBARS, the event is stored into the DBARS Recorder and also in the DBARS Exceptions, which is a Db2 table. Contrarily to the Recorder, the Exceptions table is never cleared by DBARS. If needed, the customer should provide procedures for clearing the older entries in the Exceptions.

3.11 Recorder Archiving Considerations

When an archive is initiated, access recording switches to the alternate Recorder cluster, while the primary cluster is being archived. Archiving will not interrupt the access recording process and accesses continue to be inserted while archiving progresses.

3.11.1 Automated Recorder Archiving

When the current DBARS Recorder is full, recorder switching occurs. A user provided archiving procedure will then be invoked by DBARS, if this procedure has been defined on the **ARCHIVE_PROC** startup statement. DBARS invokes the procedure using the following z/OS command:

START *procedurename*,RECID='x'

The RECID argument passed by DBARSA indicates to the called procedure which Recorder must be archived.

RECID='A' indicates the primary Recorder, RECID='B' indicates the auxiliary Recorder. When RECID='?' is specified, DBARSA will obtain the current RECID from the DBARS_RECID table.

The called procedure uses the RECID argument on the DBARSA statement, followed by the procedure variable &RECID, as shown in the example below. For a complete list of the DBARSA parameters, refer to chapter 16.

```
//DBARSARC  PROC RECID=  
//*  
//*          Archive the Recorder  
//*  
//DBARSA    EXEC PGM=DBARSA,  
//          PARM='SEQREC <DBARS_jobname> RECID &RECID'  
//ARCHIVE   DD   DSN=DBARS.ARCHIVE,  
//          DISP=(MOD,KEEP),VOL=(SER=.....),  
//          SPACE=(CYL,(...)),UNIT=SYSDA
```

3.12 Shared Recorder Considerations

Sharing of the Recorder occurs in the DBARS Writer, at the time of writing to the Recorder.

If several Db2 systems must be recorded, each Db2 system must be equipped with a corresponding DBARS address space. The name of the target Db2 subsystem should be specified in the startup parameter DB2_ADDRSPACE of each DBARS. Each of these DBARS address spaces has its own Q2. Each DBARS also has its own writer task to store Q2 into the Recorder.

Scenario 1: Recorder as a Db2 table

Two Db2 systems DB2A and DB2B are recorded. The Recorder table is held in DB2B. Two DBARS address spaces are required: DBARS1 to record DB2A and DBARS2 for DB2B.

DB2A is captured by the DBARS1 address space with the following startup parms:

DB2_SUBSYS	DB2A
DB2_ADDRSPACE	DB2ADBM1
RECORDER_LOC	DB2B

DB2B is captured by the DBARS2 address space with the following startup parms:

DB2_SUBSYS	DB2B
DB2_ADDRSPACE	DB2BDBM1

In such a setup, there are 2 recorder writer tasks: one in DBARS1 and one in DBARS2. However, due to the RECORDER_LOC DB2B statement, the DBARS1 writer will connect to DB2B before performing the insert into the Recorder table. The DBARS2 writer will simply insert using its default connection.

The customer should ensure that a DRDA connection is available to DBARS1 for connecting and inserting into the recorder table maintained in DB2B.

Please note that Recorders on a Db2 table should be used only for low-activity Db2 systems.

Scenario 2: Recorder as a VSAM cluster

Two Db2 systems DB2A and DB2B are recorded. Two DBARS address spaces are required: DBARS1 to record DB2A and DBARS2 for DB2B.

DB2A is captured by the DBARS1 address space with the following startup parms:

```
DB2_SUBSYS      DB2A
DB2_ADDRSPACE   DB2ADBM1
```

DB2B is captured by the DBARS2 address space with the following startup parms:

```
DB2_SUBSYS      DB2B
DB2_ADDRSPACE   DB2BDBM1
```

The recorder is defined using the VSAM share options (4,3). This will allow to insert into the VSAM cluster from the 2 DBARS systems.

Please note the significant VSAM enqueueing overhead of share options (4,3).

Scenario 3: Using the Centralized Recorder Service

Two Db2 systems DB2A and DB2B are recorded. Two DBARS address spaces are required: DBARS1 to record DB2A and DBARS2 for DB2B.

A third address space is required for the DBARSCRS program that implements the centralized Recorder.

The DBARS startup parameters for DBARS1 and DBARS2 contain the statement **CRS xxx.xxx.xxx.xxx:yyy** where:

```
xxx.xxx.xxx.xxx  the IP address of the z/OS system that runs DBARSCRS
yyy              the TCP/IP port where DBARSCRS is listening on
```

As a result, the participating DBARS instances do not write to the Recorder but send their audit data to the CRS server over TCP/IP.

Notes

- If DBARS1 and DBARS2 run on the same z/OS system as DBARSCRS, the Db2 systems may bypass TCP/IP sockets and store their audit data directly into the DBARSCRS queue. This is achieved by supplying the **CRS DBARSCRS** statement in the DBARS startup parms.
- This scenario also allows for sharing BSAM recorders.

3.13 DBARS Storage requirements

3.13.1 Storage pool 241 requirements

Following DBARS control blocks reside in storage pool 241:

Buffer	Size
DBARS Common Area	4 K
Dynamic user list	64 K
Ignore list	Number of ignore items * 24 bytes

3.13.2 Storage requirements in the Db2 address space

- The DBARS Initiator requires 1MB of working storage in the Db2 address space.
- A 256K storage block is acquired for trace buffers.
- The size of the DBARS Initiator component is 224K.

3.13.3 Storage requirements in the DBARS address space

- The DBARS logic modules require less than 1 MB in the address space.
- Dynamic recording buffers are acquired above the "bar" in 64-bit storage. These buffers are owned by the DBARS address space and are shared with the DBARS component executing in the Db2DBM1 address space.
- The DBARS Q2 is owned by the DBARS address space and resides in 64-bit storage. Its size, in Megabytes, is specified by the Q2_SIZE startup parameter. The parameter defaults to 1024 MB.
- The suggested DBARS region size is 0M.

3.13.4 MEMLIMIT specification for DBARS startup

The MEMLIMIT specification should provide for:

- The amount of 64-bit storage allocated to Q2 using the Q2_SIZE startup parameter.
- The size of the work segments required by the DBARS Initiator. The size of these segments should not be inferior to 64 MB. For busy systems, 128 MB is suggested.
- **The MEMLIMIT specification must be expressed in Megabytes.**

Example:

Given a Q2_SIZE of 4096 MB (4 GB) and a work segment size of 128 MB, MEMLIMIT=4224 should be specified.

Please note that the use of the above buffers is dynamic: unused buffers will not compete for real storage and not affect performance.

4 Sample DBARS JCL

4.1 Start DBARS with a VSAM Recorder.

```
//DBARS      PROC
//MAIN       EXEC PGM=DBARS,MEMLIMIT=xxxxM,PARM='DBARS.JCLLIB(parm_name) '
//STEPLIB   DD DSN=DBARS.LOADLIB,DISP=SHR
//          DD DSN=DSNx10.DBxG.SDSNEXIT,DISP=SHR
//          DD DSN=DSNx10.SDSNLOAD,DISP=SHR
//RECORDA   DD DSN=DBARS.RECORDER.A,DISP=SHR
//RECORDAX  DD DSN=DBARS.RECORDER.A.INDEX,DISP=SHR
//RECORDB   DD DSN=DBARS.RECORDER.B,DISP=SHR
//RECORDBX  DD DSN=DBARS.RECORDER.B.INDEX,DISP=SHR
//SYSPRINT  DD SYSOUT=A
//SYSUDUMP  DD SYSOUT=A
//SYSTSPRT  DD SYSOUT=A
```

MEMLIMIT

To compute the MEMLIMIT value see [DBARS Storage requirements](#).

PARM

Specify the name of the member in DBARS.JCLLIB that provides the DBARS startup parameters. See [DBARS startup parameters](#).

VSAM DD's

The VSAM cluster names in the above example are the default ones. Replace them with names conforming to your local naming conventions.

4.2 Start DBARS with a BSAM Recorder.

```
//DBARS      PROC
//MAIN       EXEC PGM=DBARS, MEMLIMIT=xxxxM, PARM='DBARS.JCLLIB (parm_name) '
//STEPLIB    DD DSN=DBARS.LOADLIB, DISP=SHR
//           DD DSN=DSNx10.DBxG.SDSNEXIT, DISP=SHR
//           DD DSN=DSNx10.SDSNLOAD, DISP=SHR
//SYSPRINT   DD SYSOUT=A
//SYSUDUMP   DD SYSOUT=A
//SYSTSPRT   DD SYSOUT=A
```

MEMLIMIT

To compute the MEMLIMIT value see [DBARS Storage requirements](#).

PARM

Specify the name of the member in DBARS.JCLLIB that provides the DBARS startup parameters. See [DBARS startup parameters](#)

DD statements

They are not required since DBARS allocates them using your SAM_PREFIX specification, described in [DBARS startup parameters](#).

The DD names generated by DBARS are RECORDSA for the primary Recorder and RECORDSB for the secondary Recorder.

Following dataset names are generated:

<sam_prefix>.RECORDER.SA and <sam_prefix>.RECORDER.SB for the primary resp. the secondary Recorder.

4.3 Procedure to archive a VSAM Recorder.

```
//DBARSARC PROC RECID=  
//DBARSA EXEC PGM=DBARSA, PARM='SEQREC <Jobname> RECID &RECID'  
//ARCHIVE DD DSN=DBARS.ARCHIVE, DISP=(MOD,KEEP),  
//          VOL=(SER=xxxx), SPACE=(CYL,(xxx,xxx)), UNIT=SYSDA  
//RECORDA DD DSN=DBARS.RECORDER.A, DISP=SHR  
//RECORDB DD DSN=DBARS.RECORDER.B, DISP=SHR  
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR  
//SYSPRINT DD SYSOUT=A  
//SYSUDUMP DD SYSOUT=A
```

The optional archive procedure is automatically invoked by DBARS when a Recorder is full, before switching to the alternate Recorder.

The name of the archive procedure is specified by the ARCHIVE_PROC statement in [DBARS startup parameters](#).

SEQREC

Designates a VSAM Recorder.

Jobname

Specify the name of the DBARS address space that actually writes to the VSAM Recorder.

RECID

The procedure variable is assigned by DBARS when invoking the archiving procedure. Its value will be A for the primary and B for the secondary Recorder. If RECID='?' is specified, the current RECID will be obtained from the DBARS_RECID table.

4.4 Procedure to archive a BSAM Recorder.

The optional archive procedure is automatically invoked by DBARS when a Recorder is full, before switching to the alternate Recorder.

The name of the archive procedure is specified by the ARCHIVE_PROC statement in [DBARS startup parameters](#).

```
//DBARSARC PROC RECID=  
//DBARSA EXEC PGM=DBARSA, PARM='SEQRECS <SAM_prefix> <Jobname> +  
// RECID &RECID'  
//ARCHIVE DD DSN=DBARS.ARCHIVE, DISP=(MOD,KEEP),  
// VOL=(SER=xxxx), SPACE=(CYL,(xxx,xxx)), UNIT=SYSDA  
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR  
//SYSPRINT DD SYSOUT=A  
//SYSUDUMP DD SYSOUT=A
```

SEQRECS

Designates a BSAM Recorder.

SAM_prefix

Specify your SAM_PREFIX specification previously defined in your startup parameters. See [DBARS startup parameters](#).

Jobname

Specify the name of the DBARS address space that actually writes to the BSAM Recorder.

RECID

The procedure variable is assigned by DBARS when invoking the archiving procedure. Its value will be A for the primary and B for the secondary Recorder.

DD statements for the Recorder are not required since DBARS allocates them using your sam_prefix specification.

4.5 Start the Centralized Recorder Service with a VSAM Recorder.

```
//DBARSCRS JOB (xxx), 'xxx', CLASS=A, MSGCLASS=A, REGION=0M,
//          USER=xxxx, PASSWORD=xxx, MSGLEVEL=(1,1),
//          MEMLIMIT=1024M
//DBARSCRS EXEC PGM=DBARSCRS
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
//          DD DSN=DSNx10.DBxG.SDSNEXIT, DISP=SHR
//          DD DSN=DSNx10.SDSNLOAD, DISP=SHR
//RECORDA DD DSN=DBARS.RECORORDER.A, DISP=SHR
//RECORDAX DD DSN=DBARS.RECORORDER.A.INDEX, DISP=SHR
//RECORDB DD DSN=DBARS.RECORORDER.B, DISP=SHR
//RECORDBX DD DSN=DBARS.RECORORDER.B.INDEX, DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSTSPRT DD SYSOUT=A
//SYSUDUMP DD SYSOUT=A
//SYSIN DD *
```

Parameters controlling CRS operation are read from SYSIN. These parameters are described in [8.1 Starting the DBARSCRS server](#).

Specifying MEMLIMIT on the JOB statement is also described in this section.

4.6 Start the Centralized Recorder Service with a BSAM Recorder.

```
//DBARSCRS JOB (xxx), 'xxx', CLASS=A, MSGCLASS=A, REGION=0M,
//          USER=xxx, PASSWORD=xxx, MSGLEVEL=(1,1),
//          MEMLIMIT=1024M
//DBARSCRS EXEC PGM=DBARSCRS, PARM='DEBUG=NO, TALK=NO'
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
//          DD DSN=DSNx10.DB9G.SDSNEXIT, DISP=SHR
//          DD DSN=DSNx10.SDSNLOAD, DISP=SHR
//RECORDSA DD DSN=<SAM_prefix>.RECORDER.SA, DISP=SHR
//RECORDSB DD DSN=<SAM_prefix>.RECORDER.SB, DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSPRT DD SYSOUT=A
//SYSUDUMP DD SYSOUT=A
//SYSIN DD *
```

DD statements

Code the DD statements for RECORDSA and RECORDSB using your SAM_prefix.

Parameters controlling CRS operation are read from SYSIN. These parameters are described in [8.1 Starting the DBARSCRS server](#).

Specifying MEMLIMIT on the JOB statement is also described in this section.

5 Blocking Database Access

BLOCK statements are placed in a z/OS dataset whose name is specified on the RULES startup statement described in [DBARS startup parameters](#). The dataset should be in the same z/OS library as the DBARS startup statement member.

Please note that the DBARS block requests only affect accesses to Db2 tables that are in the DBARS AUDITNAMES section.

Syntax

```
BLOCK    WHEN <data_item> <operator> <data_value>
          [AND <data_item> <operator> <data_value>]
          ...
          [AND <data_item> <operator> <data_value>]
```

Data_item

ACCESS	SELECT INSERT UPDATE DELETE
CONNECTION	TSO CICS DDF BATCH
DYNAMIC_SQL	true if SQL executed in dynamic mode
EXTAPPL	application name when remote access
EXTSERVER	server name (IP-address) if remote (DDF) access location name if local access
EXTWS	name of workstation when remote access
JOB	name of batch job or correlation
PROGRAM	name of application program
ROWS	number of rows updated, deleted or inserted
SERVER	name of Db2 subsystem
TABLE	creator.tablename - name of a table audited by DBARS - generic tablename are not allowed
TIME	time values must have the format hhmm
USER	Db2 userid

Operator

omitted	tests equal (greater or equal for data_item ROWS)
NOT	tests not equal
BETWEEN x AND y	tests within range

Data_value

The value to compare <data-item> with. Comparison is done over the specified length of data-value, thus allowing for a generic test.

The data-value **ANY** compared with a data-item that is not blank, evaluates the expression as true.

Additional Syntax Rules

- Alphanumeric values should not be enclosed in quotes.
- Rules that do not fit on one dataset line should be broken at the AND keyword.
- If multiple conditions are specified on a blocking line using the AND keyword, all conditions must be true for blocking to be performed.
- If OR-ed conditions are needed, they should be specified on separate BLOCK statements.
- Comment lines are allowed: such lines should start with an asterisk.

When an access has been blocked, the following message is written to the z/OS SYSLOG:

DBARSI551A Access has been blocked.

The user receives a 60F z/OS abend and the access is recorded with an SQLCODE -90001. The user session is then terminated by DBARS.

The blocked access is stored in both the DBARS Recorder and the DBARS Exceptions table.

If the DBARSNAX facility has been enabled, an email - with all details of the Db2 access - will be sent to specified recipients.

The DBARSNAX facility is documented in the chapter [Notify access exceptions by email](#).

Examples

During the night-shift, user N457 can use only program names beginning with NCB:

```
BLOCK WHEN USER N457
AND TIME BETWEEN 1800 AND 0800
AND PROGRAM NOT NCB
```

Only users in the accounts receivable department can update the customer table using CICS:

```
BLOCK WHEN TABLE NTR.CUSTOMER
AND ACCESS NOT SELECT
AND USER NOT ACR
AND CONNECTION NOT CICS
```

The Employee table cannot be accessed from an IP-address:

```
BLOCK WHEN TABLE DSN8A10.EMP
AND EXTSERVER ANY
```

The Employee table cannot be accessed using dynamic SQL:

```
BLOCK WHEN TABLE DSN8A10.EMP
AND DYNAMIC_SQL
```

6 Alerting Database Access

ALERT statements are placed in a z/OS dataset whose name is specified on the RULES statement described in [DBARS startup parameters](#). The dataset should be in the same z/OS library as the DBARS startup statement member.

Syntax

```
ALERT      WHEN <data_item> <operator> <data_value>
           [AND <data_item> <operator> <data_value>]
           ...
           [AND <data_item> <operator> <data_value>]
```

Data_item

ACCESS	SELECT INSERT UPDATE DELETE
CONNECTION	TSO CICS DDF BATCH
DYNAMIC_SQL	true if SQL executed in dynamic mode
EXTAPPL	application name when remote access
EXTSERVER	server name (IP-address) if remote (DDF) access name of database if local access
EXTWS	name of workstation when remote access
JOB	name of batch job or correlation
PROGRAM	name of application program
ROWS	number of rows updated, deleted or inserted
SERVER	name of Db2 subsystem
TABLE	creator.tablename - name of a table audited by DBARS - generic tablename are not allowed
TIME	time values must have the format hhmm
USER	Db2 userid

Operator

omitted	tests equal (greater or equal for data_item ROWS)
NOT	tests not equal
BETWEEN x AND y	tests within range

Data_value

The value to compare <data-item> with. Comparison is done over the specified length of data-value, thus allowing for a generic test

Additional Syntax Rules

- Alphanumeric values should not be enclosed in quotes.
- Rules that do not fit on one dataset line should be broken at the AND keyword.
- If multiple conditions are specified on a line using the AND keyword, all conditions must be true for alerting to be performed.
- If OR-ed conditions are needed, they should be specified on separate ALERT statements.
- Comment lines are allowed: such lines should start with an asterisk.

When an alert is issued for an access, the SQL statement is stored in the DBARS Exception table and in the DBARS Recorder.

If the DBARSNAX facility has been enabled, an email - with all details of the Db2 access - will be sent to specified recipients.

The DBARSNAX facility is documented in the chapter [Notify access exceptions by email](#).

When an ALERT_PROC is specified, the designated REXX procedure is invoked. In both cases the access is recorded with an SQLCODE -90002.

For details on alert exits, refer to the next section "Writing a DBARS alert exit".

Examples

Alert when during the night-shift, user N457 uses programs other than those beginning with NCB:

```
ALERT WHEN USER N457
AND TIME BETWEEN 1800 AND 0800
AND PROGRAM NOT NCB
```

Alert when a user updates the customer table and his userid does not start with ACR and connection is not via CICS:

```
ALERT WHEN TABLE NTR.CUSTOMER
AND ACCESS NOT SELECT
AND USER NOT CR
AND CONNECTION NOT CICS
```

Writing a DBARS ALERT exit

A DBARS alert exit is declared with an ALERT_PROC statement in the EXECPARM member of the DBARS JCLLIB. The user exit is written in REXX and called by the DBARS Writer task before the access is stored in the Recorder table.

The exit runs under the DBARS userid. At entry, there is a connection to the Db2 system that holds the DBARS Recorder table. The exit may perform any necessary action including SQL access. However, if SQL statements are issued, a COMMIT should be used before returning to DBARS.

Following arguments are passed to the exit:

Argument Number	Argument Content	Argument Length
1	Access timestamp	26
2	TCB address	8
3	Name of Db2 application server	16
4	Db2 userid	8
5	z/OS userid	8
6	Correlation name	12
7	Connection type	8
8	LUW_id	12
9	External Server Name	16
10	External Application Name	32
11	External Workstation Name	18
12	RDI Call Type	4
13	RDI Statement Type	4
14	Table Creator	8
15	Table Name	128
16	Program Name	8
17	Program Section number	4
18	SQLCODE	8
19	Number of rows processed	16
20	Operation Code	8
21	Dynamic access flag	1
22	Length of SQL Statement_text	8
23	Pointer to SQL Statement_text	8

7 Notify access exceptions by email

When a Db2 access has been blocked by DBARS or when DBARS has issued an alert for a Db2 access, the access is stored in the DBARS Exceptions table.

The DBARSNAX facility will send the Exceptions entry to a specified email address.

The facility consists of a component that executes on z/OS and a component that runs as a Windows process.

The z/OS component continuously polls the Exceptions table for new entries. When one is found, the Exceptions data is extracted and passed to the Windows component, which will compose the email message and send it to the designated recipient(s).

Installing DBARSNAX on z/OS

DBARSNAX is automatically installed on z/OS during DBARS installation.

Running DBARSNAX on z/OS

```
//DBARSNAX JOB <job parameters>
//DBARSNAX EXEC PGM=DBARSNAI, PARM='PORT=, TCPIP='
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
// DD DSN=DSNC10.DBCG.SDSNEXIT, DISP=SHR
// DD DSN=DSNC10.SDSNLOAD, DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSPRINT DD SYSOUT=A
//SYSTSPRT DD SYSOUT=A
//SYSUDUMP DD SYSOUT=A
```

The above JCL will start DBARSNAX.

- The PORT parameter defines the TCP/IP port where the program listens on messages from the Windows component. If not specified, PORT defaults to 4947.
- The TCPIP parameter specifies the name of the TCP/IP address space. It defaults to "TCP/IP".

Terminating DBARSNAX on z/OS

DBARSNAX is a never-ending application. It should be stopped using the STOP DBARSNAX z/OS command.

Installing DBARSNAX on Windows

Copy the DBARSNAX folder from the DBARS distribution material to the Windows workstation that will run DBARSNAX.

Configuring DBARSNAX on Windows

- Update the mainframe IP-address and the DBARSNAX port in DBARSNAX.BAT

```
java -jar DBARSNAX.jar <mainframe_IPaddress> <DBARSNAX port>
```

- Update the configuration file DBARSNAX.TXT by inserting the actual values for the required statements.

```
/*
/*      Required statements
/*
HOST    xxxx.xxxxxx.xx          /* Name of SMTP host
PORT    xx                      /* Port of SMTP host
FROM    xxx@xxxxxxxxxxxxx      /* Sending email address
TO      xxx@xxxxxxxxxxxxx      /* Email address of primary recipient

/*      Optional statements
/*
/*      SSL    YES | NO        - YES if SMTP server supports SSL
/*                                     - NO if it does not
/*                                     (Normally detected by JavaMail)
/*      CC     emailaddress    - Email address of copied recipient
/*                                     (Multiple CC statements allowed)
/*      DEBUG  ON              - Debugs JavaMail
```

Running DBARSNAX on Windows

Run DBARSNAX.BAT. Terminate DBARSNAX using Windows facilities.

Please note that DBARSNAX is a Java application. It requires Java Runtime Environment level 8 or higher.

8 SQL Reduction Facility

Some processes (typically batch jobs) execute long sequences of identical SQL statements, different in their data values only. The SQL reduction feature will reduce such sequence to a single SQL statement, with the data values masked. The reduced statement is written as such to the DBARS Recorder.

Reduction is performed once a day for the reduction "key". The key contains the user-id, the program-name and the connection type.

For example:

```
INSERT INTO T1(C1) VALUES(10)
INSERT INTO T1(C1) VALUES(11)
INSERT INTO T1(C1) VALUES(12)
INSERT INTO T1(C1) VALUES(13)
```

will be reduced to `INSERT INTO T1(C1) VALUES(##)` and written as such to the DBARS Recorder.

The reduction facility does not require control datasets for its operations. Instead hashing algorithms are used to reduce the statement text to a 64-bit number. A 3-MB memory object in 64-bit storage is used to maintain the hash results.

SQL reduction may be requested for all SQL statements. Alternatively, reduction may be requested for designated jobs or programs.

SQL reduction is enabled in the DBARS startup parameters, by coding: `OPTIONS REDUCE_SQL`. Refer to [DBARS startup parameters](#) of the manual.

The `REDUCE_SQL` option alone will cause reduction of all SQL statements.

If this is not desired, the `REDUCEP` member in the DBARS JCLLIB may be used to selectively implement reduction. After installing DBARS, `REDUCEP` contains a single line with the % sign, causing overall reduction.

Syntax of the reduction statement:

*	marks a comment line
%	reduces all SQL statements
JOB name[%]	reduces the SQL issued by the named job(s)
PRG name[%]	reduces the SQL issued by the named program(s)
USR name[%]	reduces the SQL issued by the named user(s)

9 Centralized Recorder Service

By default, each DBARS instance needs to be equipped with a Recorder Dataset. The **Centralized Recorder Service** allows to share the DBARS Recorder between address spaces and LPARs. The CRS facility is implemented by the DBARSCRS program, which executes in its own z/OS address space.

DBARS instances connected to CRS communicate with the CRS address space using TCP/IP sockets. Alternatively, DBARS instances running on the same z/OS system as CSR, may directly store their audit data into the DBARSCRS queue.

The CRS facility is initiated by coding the CSR statement in the DBARS startup parameters. See [DBARS startup parameters](#).

9.1 Starting the DBARSCRS server

The DBARSCRS JCL should provide the DD statements for the DBARS Recorder where DBARSCRS will be writing to.

Following control statements should be submitted after the SYSIN DD.

Common statements

RECTYPE	The access method used for the Recorder (VSAM or BSAM)
INDEXING	Specify YES if the VSAM Recorder index should be used. Specify NO otherwise. Default is YES.
SAM_PREFIX	For RECTYPE BSAM the dataset high-level qualifier
ARCHIVE_PROC	If present, the name of the Recorder archiving procedure

Statements required when communication with CRS is done using TCPIP sockets

PORT	The TCP/IP port where DBARSCRS is listening on
TCPIP_AS	The name of the TCP/IP address space (default is TCPIP)

Statements when communication with CRS is done using the DBARSCRS queue.

Q_SIZE	The size in MB of the DBARCSR request queue. Specify the same value on the MEMLIMIT clause of the JOB statement.
--------	--

Notes

- The DBARSCRS server should be started before the DBARS instances that participate in Recorder sharing.
- A sample DBARSCRS JCL stream is stored during installation into the DBARSCRS member of the DBARS JCLLIB.

9.2 DBARSCRS commands

- **STATS** command

Displays the number of audit records received and processed.

- **RECSTATS** command

Displays the VSAM statistics for the DBARS Recorder cluster.

- **CLIENTS** command

Displays the jobnames of the DBARS instances currently connected to the Centralized Recorder server.

- **SWITCH_REC** command

When the Recorder is a sequential dataset or a VSAM cluster, the command switches between the primary and secondary Recorder in a flip-flop manner. If the primary Recorder is active, switching to the secondary Recorder occurs and vice-versa.

When the Recorder is a Db2 table, the command switches between the DBARS.RECORDER and the DBARS.AUX_RECORDER tables.

Note that a Recorder full condition automatically switches Recorders and schedules a DBARS archive procedure, if one has been defined.

Automated archiving will automatically switch Recorders. See Automated Recorder Archiving.

The command is mainly intended for use by the DBARS archiving procedures. There is usually no reason to manually submit this command.

- When all DBARS instances that share the Recorder have been terminated, use the **STOP** z/OS command to terminate DBARSCRS.

10 Writing to the Windows Event log

10.1 Description

The DBARSLOG functions write DBARS exceptions to the Windows event log named "**DBARS Alert Log**". DBARS exceptions are generated when a Db2 access is blocked (as described [above](#)) or when an alert is issued for an access (as described [above](#)).

The DBARSLOG component that executes on the mainframe transmits DBARS exception data to the DBARSLOG application that executes in Windows and that actually stores the exceptions to the Windows event log.

Data in the DBARS alert log are then available to software that exploits the Windows logs for processing (big data systems for example) .

10.2 Installing DBARSLOG

10.2.1 Installing on z/OS

The standard DBARS installation also installs the mainframe DBARSLOG component.

10.2.2 Installing on Windows

The DBARS distribution file contains a folder, named DBARSLOG. The entire folder should be moved to a Windows folder accessible to the process that will invoke DBARSLOG.

10.3 Configuring DBARSLOG

10.3.1 Configuring on z/OS

The DBARS distribution file contains in its JCL folder, the DBARSLOG SAMPJCL file, for starting the DBARSLOG server on z/OS:

EXEC PGM=DBARSLOG,PARM='PORT=...'

Specify the TCP/IP port to be used by DBARSLOG for communication with the DBARSLOG program in Windows. The default port number is 1946.

10.3.2 Configuring on Windows

The DBARS distribution folder DBARSLOG contains the DBARSLOG.BAT which starts the DBARSLOG application as follows:

DBARSLOG <IP_address> 1946

In the above command, replace:

- <IP_address> with the IP address of your z/OS system
- the default port 1946 (only if the default port was modified in the DBARSLOG PARM described above)

10.3.3 Starting the DBARSLOG server on z/OS

DBARSLOG can be started by submitting the customized DBARSLOG JCL.

Alternatively, DBARSLOG can be invoked as a started task. In this case, issue the following RACF commands to assign privileges to the started task:

```
RDEFINE STARTED DBARSLOG.DBARSLOG STDATA(USER(XXXX)  
GROUP(YYY)) SETROPTS RACLIST(STARTED) REFRESH
```

DBARSLOG issues TCP/IP Listen commands to wait for workstation requests. Note that there is no command provided to shutdown the DBARSLOG server. Use the z/OS cancel command instead.

10.3.4 Starting DBARSLOG on Windows

Start the DBARSLOG.BAT configured above.

11 Interactive Reporting from a Db2 Recorder

The online Access Reporting program DBARSIR is used to scan a Recorder that has been defined as a Db2 table. Alternatively, DBARSIR can be used to scan a result Db2 table produced by the other DBARS reporting programs.

DBARSIR is called from a TSO session using the TSO command

```
CALL 'DBARS.LOADLIB(DBARSIR)' ['SSID=xxxx']
```

or using an installation defined ISPF shortcut.

The SSID parameter on the above CALL statement can be used if the TSO session is not implicitly connected to the Db2 subsystem where the DBARS tables reside, that is, if the TSO login procedure does not contain a DD statement for the corresponding SDSNEXIT dataset.

DBARSIR can be invoked only if the TSO terminal has at least 32 lines.

11.1 Entering Report Criteria

At entry into the DBARSIR program, the report selection criteria are requested. Report criteria can be entered for the columns of the Recorder table and for expressions in the recorded SQL statement text.

11.1.1 Recorder Table Column Criteria

Enter selection values for one or more of the following table columns:

Recording date	Date of the recorded access (as a valid Db2 date expression)
Recording time	Time of the access (as a valid Db2 time expression)
Table creator	Creator of the table accessed
Table name	Name of the table accessed
Appl server	Name of the Db2 system where the SQL statement was executed
Db2 authid	Db2 userid issuing the recorded SQL statement
z/OS userid	z/OS userid issuing the recorded SQL statement
Correlation name	Name of the process issuing the recorded SQL statement (for example the z/OS job name)
Connection type	Type of the users Db2 connection (BATCH, TSO ..)
Appl requester	Name of the Db2 system sending the SQL statement

Ext_application	Name of the external application issuing the SQL statement (distributed data access only)
Ext_workstation	Name of the workstation issuing the SQL statement (distributed data access only)
Program name	Name of the program containing the recorded SQL statement
Statement type	Type of the recorded SQL statement as SELECT, INSERT, DELETE or UPDATE
SQLCODE	SQLCODE resulting from statement execution
SQLROWS	Number of rows modified by the statement
Location	Name of the Db2 subsystem where the recorded statement was executed
Dynamic SQL	<ul style="list-style-type: none"> • Y will report SQL statements executed in dynamic mode • N will report SQL statements executed in static mode • blank will report both static and dynamic statements
Order by	<p>Insert the column-names or column-numbers for sorting the report. If multiple columns are specified, they should be separated by a comma. The keywords ASC and DESC request an ascending or descending order.</p> <p>For example:</p> <pre>ORDER BY Db2_ID, ACCESS_STAMP DESC</pre> <p><i>or</i></p> <pre>ORDER BY 5, 1 DESC</pre>

Criteria syntax rules:

- Criteria can be entered as a simple value, for example:
TABLE NAME : **CUSTOMER**
- A generic value may be supplied using a trailing % sign, for example:
PROGRAM NAME : **DSQ%**
- Selection criteria may be entered as a Db2 expression, for example:
STATEMENT TYPE : **<> 'SELECT'**
or
RECORDING DATE : **> CURRENT DATE - 2 MONTHS**
- Db2 expressions on recorder table columns are executed using Db2 calls. Therefore, these expressions must obey Db2 syntax rules. All columns of the Recorder table, except SQLCODE and SQLROWS, have the CHARACTER format. Search values entered for CHARACTER columns must be enclosed in quotes.
- When multiple selection values are entered, the Recorder table rows must satisfy all criteria before being selected.

ORDER BY column-names and column-numbers

<u>Column-nr</u>	<u>Column-name</u>
1	ACCESS_STAMP
2	DATE (ACCESS_STAMP)
3	TIME (ACCESS_STAMP)
4	LOCATION
5	DB2_ID
6	MVS_ID
7	CORRELATION
10	TCREATOR
11	TNAME
12	PROGRAM
13	STMNTNR
14	SQLCODE
15	SQLROWS
16	OPCODE
17	DYNAMIC
18	CONNECT_ID
19	LUWID
20	EXT_SERVER
21	EXT_APPL
22	EXT_STATION

11.1.2 SQL text expressions

Recorded accesses may be selected by examining the text of the recorded SQL statement.

An SQL text expression consists of a **column_name** with an optional **column_value**. When a column_value is supplied, it is connected to the column_name by an **operator**.

When a column_name is specified alone, recorded statements will be reported as soon as they contain a reference to the column_name.

When a column_name with an operator and a column_value are specified, recorded statements are reported when they reference the column_name with the specified value.

The supplied expression is checked against:

- the INSERT VALUES clause
- the UPDATE SET clause
- the WHERE clause when present

When specifying text expressions, ensure that the table name and eventually a table creator are entered in the corresponding columns.

Expression Syntax Rules

- The column expression has the format:
column_name operator column_value
- The operator should be entered as:
 - = to test equal
 - < to test lower than
 - > to test higher than
 - <= to test lower or equal than
 - >= to test higher or equal than
 - <> to test not equal
 - LIKE to perform a generic test using a trailing % sign
- Column_values may, but need not, be enclosed in quotes.
- Leading zeroes need not be supplied for a column that is logically numerical, even if it has been defined as character to Db2.
- The elements of the expression may, but need not, be separated by one or more blanks.
- Up to 3 column expressions can be specified on the criteria panel.
- When multiple column expressions are specified, a recorded statement will be reported only when it satisfies all the expressions.

Examples

(1) Table-Name EMP_MED_HIST
Statement-Type SELECT
Text-expression-1 EMPNO = 100

Reports all recorded SELECT's on the medical history of employee 100.

(2) Table-Name EMPLOYEE
Statement-Type UPDATE
Text-expression-1 EMPNO = 100
Text-expression-2 SALARY

Reports all recorded UPDATE's on the SALARY of employee number 100.

(3) Table-Name CUSTOMERS
Text expression-1 CUSTNAME LIKE FREI%

Reports all recorded accesses to customer names matching the generic specification.

11.2 PFkey Assignments on the Report Criteria Screen

- PF1 Displays a help file.
- PF2 Calls the User Summary Report using the specified report criteria.
The summary report is described below.
- PF3 Terminates the report program.
- PF4 Allows to specify the name of a Db2 table into which DBARS recorder data have been stored². By default, the DBARS RECORDER table is used for reporting. The Db2 tablename selected here will be remembered across DBARSIR sessions.
- PF5 Recalls the previous report selection parameters³
- PF6 Recalls the next report selection parameters

² For example:

- an archive table created using the TABLE keyword of the DBARSA program
- a report output table created using the OUTTABLE keyword of the DBARSRR program

³ All report selection parameters are saved into a Db2 table, for the active TSO userid. Up to 32 sets of selection parameters are retained. Using the PF5 and PF6 keys, the user can browse these saved parameter sets.

11.3 Processing the Access Report

When the report criteria have been entered, DBARSIR selects the requested rows from the Recorder table into a list and displays the first page of that list on the terminal.

Program Function keys (PFkeys) are used to process the report list. Some of the PFkeys operate on the "current row", that is the row on the line pointed to by the cursor. To execute these functions, move the cursor to the line showing the object and press the corresponding PF key.

Only the PF keys labelled with a function name on the bottom of the screen are enabled.

- PF1 Requests help.
- PF2 Shows the SQL statement text in formatted mode.
- PF3 Terminates list display.
- PF4 If in list mode, takes a hardcopy of the entire list.
If in page mode, takes a hardcopy of the current screen.
- PF5 Invokes the "format" function.

The format function displays all column names in the list, preceded by a + sign if the column is displayed or by a - sign if the column has been hidden previously. You may override the + or - sign in the following manner:

- + Unhides a previously hidden column, i.e. the column will be displayed again.
 - Hides a column so that it is no longer displayed, although it remains in the list.
 - < Sorts the list on this column in ascending sequence (low to high). Only one ordering column can be designated.
 - > Sorts the list on this column in descending sequence . Only one ordering column can be designated.
 - 2-9 Entering a number from 2 to 9 will move the column to the corresponding position in the list. The column previously on that position will take the position of the column moved.
- PF6 Places the current line on the first line of the list.
 - PF7 Displays the previous page in the list.
 - PF8 Displays the next page in the list.
 - PF9 Makes the first line of the last page in the list current.

PF10 When displaying the list in pagemode, calls the "Search" function which allows to search list columns on their value. Search can be done using the logical operators = ^= > >. Functions are also provided to locate the highest and lowest column value in the list.

When in listmode, moves the display window to the left.

PF11 Moves the display window to the right if the screen capacity does not allow to display the entire list line.

PF12 Swaps the listformat between column and page mode.

In column mode, several table rows are displayed on one screen.
In page mode, only one row is displayed.

ENTER Will make the object on the line pointed to by the cursor to the current object and highlight it. Other functions may operate on the "current object". Pressing ENTER is not required : it is sufficient to place the cursor on the required line and press the function PFkey. On return from the function, the object will be shown as current automatically.

11.4 User Access Summary Report

The User Access Summary reports accesses to audited Db2 tables in an hierarchical manner.

Before entering the Access Summary program, the user has specified search criteria that create a subset of the Recorder table rows.

On entry, the Access Summary displays the **User List** containing all distinct Db2 userids that appear in the selected Recorder table rows.

From the **User List**, the Detail function (PF4) displays the **Program List** for the selected user.

From the **Program List**, the Detail function displays the **Statement List** for the selected user and program.

Following PF keys are used to execute a particular function on a summary list. Some of the functions operate on the "current row", that is the row on the line pointed to by the cursor. When executing these functions, move the cursor to the line showing the object and press the corresponding PF key.

Only the PF keys labelled with a function name on the bottom of the screen are enabled.

PF1 Requests help.

PF3 Terminates list display or returns to a previous list, if any.

PF4 When in the User List, the Detail function produces a list of all programs by which the current userid has accessed Db2.

When in the Program List, the Detail function produces a list of all program statements by which the current userid has accessed Db2.

PF6 Places the current line on the first line of the list.

PF7 Displays the previous page in the list.

PF8 Displays the next page in the list.

PF9 Makes the first line of the last page in the list current.

ENTER Will make the object on the line pointed to by the cursor to the current object and highlight it. Other functions may operate on the "current object". Pressing ENTER is not required : it is sufficient to place the cursor on the required line and press the function PFkey. On return from the function, the object will be shown as current automatically.

12 Interactive Reporting from a sequential or a VSAM Recorder

The online Access Reporting program DBARSRRI is used to scan a Recorder that has been defined as a sequential dataset or a VSAM cluster. DBARSRRI can be invoked only if the TSO terminal has at least 32 lines.

For a sequential Recorder, DBARSRRI is called from a TSO session using the TSO command:

EXEC 'DBARS.JCLLIB(DBARSRRS)' ['SSID=xxxx'] or using an installation defined ISPF shortcut. The SAM_PREFIX argument in the DBARSRRS member should be set to the SAM_PREFIX as defined in [DBARS startup parameters](#).

For a VSAM Recorder, DBARSRRI is called from a TSO session using the TSO command:

EXEC 'DBARS.JCLLIB(DBARSRRX)' ['SSID=xxxx'] or using an installation defined ISPF shortcut.

12.1 Entering Report Criteria

At entry into the DBARSRRI program, the report selection criteria are requested. Report criteria can be entered for the columns of the Recorder and for expressions in the recorded SQL statement text.

12.1.1 Recorder Column Criteria

Enter selection values for one or more of the following Recorder columns:

Recording date	Date of the recorded access ⁴
Recording time	Time of the access ⁵
Table creator	Creator of the table accessed
Table name	Name of the table accessed
Appl server	Name of the Db2 system where the SQL statement was executed
Db2 authid	Db2 userid issuing the recorded SQL statement
z/OS userid	z/OS userid issuing the recorded SQL statement

⁴ Recording date can be entered as a valid Db2 date expression, with the following restrictions:

- The IN operator should not be used
- If the BETWEEN operator is used, the arguments should be absolute date/time values, for example 2008-10-02 or 10.20.22. Special registers are not allowed as BETWEEN arguments.

⁵ Recording time can be entered as a valid Db2 time expression, with the same restrictions mentioned above for date expressions.

Correlation name	Name of the process issuing the recorded SQL statement (for example the z/OS job name)
Connection type	Type of the users Db2 connection ('BATCH', 'TSO', ...)
Appl requester	Name of the Db2 system sending the SQL statement
Ext_application	Name of the external application issuing the SQL statement (distributed data access only)
Ext_workstation	Name of the workstation issuing the SQL statement (distributed data access only)
Program name	Name of the program containing the recorded SQL statement
Statement type	Type of the recorded SQL statement as SELECT, INSERT, DELETE or UPDATE
SQLCODE	SQLCODE resulting from statement execution
SQLROWS	Number of rows modified by the statement
Location	Name of the Db2 subsystem where the recorded statement was executed

Dynamic SQL

- Y will report SQL statements executed in dynamic mode
- N will report SQL statements executed in static mode
- blank will report both static and dynamic statements

DBARS RegionName

If the jobname of the DBARS address space is different from "DBARS", specify the jobname.

If multiple Db2 systems are recorded, you should specify the name of the DBARS region that records the intended Db2 system.

Criteria syntax rules:

- Criteria can be entered as a simple value, for example:
TABLE NAME : **CUSTOMER**
- A generic value may be supplied using a trailing % sign, for example:
PROGRAM NAME : **DSQ%**
- Selection criteria may be entered as a Db2 expression, for example:
STATEMENT TYPE : **<> 'SELECT'**
or
RECORDING DATE : **> CURRENT DATE - 2 MONTHS**
- Db2 expressions must obey Db2 syntax rules.
- When multiple selection values are entered, the Recorder table rows must satisfy all criteria before being selected.

12.1.2 Accelerating the Recorder scan

Since the Recorder is a VSAM ESDS, scanning is essentially a sequential process. However, DBARS maintains an index on the ESDS to allow for faster scans. The Recorder index is on date and time.

To speed up a scan, specify the Recording date column as a non-generic value (for example CURRENT DATE or 2018-12-12). When a date is supplied, the scan may be further accelerated by supplying a time value (which may be generic).

12.1.3 SQL text expressions

Recorded accesses may be selected by examining the text of the recorded SQL statement.

An SQL text expression consists of a **column_name** with an optional **column_value**. When a column_value is supplied, it is connected to the column_name by an **operator**.

When a column_name is specified alone, recorded statements will be reported as soon as they contain a reference to the column_name.

When a column_name with an operator and a column_value are specified, recorded statements are reported when they reference the column_name with the specified value.

The supplied expression is checked against:

- the INSERT VALUES clause
- the UPDATE SET clause
- the WHERE clause when present

When specifying text expressions, ensure that the table name and eventually a table creator are entered in the corresponding columns.

Expression Syntax Rules

- The column expression has the format:
`column_name operator column_value`
- The operator should be entered as:
 - = to test equal
 - < to test lower than
 - > to test higher than
 - <= to test lower or equal than
 - >= to test higher or equal than
 - <> to test not equal
 - LIKE to perform a generic test using a trailing % sign
- Column_values may, but need not, be enclosed in quotes.
- Leading zeroes need not be supplied for a column that is logically numerical, even if it has been defined as character to Db2.
- The elements of the expression may, but need not, be separated by one or more blanks.
- Up to 3 column expressions can be specified on the criteria panel.
- When multiple column expressions are specified, a recorded statement will be reported only when it satisfies all the expressions.

Examples

(1) Table-Name EMP_MED_HIST
Statement-Type SELECT
Text-expression-1 EMPNO = 100

Reports all SELECT's on the medical history of employee 100.

(2) Table-Name EMPLOYEE
Statement-Type UPDATE
Text-expression-1 EMPNO = 100
Text-expression-2 SALARY

Reports all recorded UPDATE's on the SALARY of employee 100.

(3) Table-Name CUSTOMERS
Text expression-1 CUSTNAME LIKE FREI%

Reports all recorded accesses to customer names matching the generic specification.

12.2 PFkey Assignments on the Report Criteria Screen

- PF1 Displays a help file.
- PF3 Terminates the report program.
- PF5 Recalls the previous report selection parameters (*)
- PF6 Recalls the next report selection parameters (*)

(*) Note

All report selection parameters are saved into a Db2 table, for the active TSO userid. Up to 32 sets of selection parameters are retained. Using the PF5 and PF6 keys, the user can browse these saved parameter sets.

12.3 Processing the Access Report

When the report criteria have been entered, DBARSRRRI selects the requested rows from the Recorder table a list and displays the first page of that list on the terminal.

Program Function keys (PFkeys) are used to process the report list. Some of the PFkeys operate on the "current row", that is the row on the line pointed to by the cursor. To execute these functions, move the cursor to the line showing the object and press the corresponding PF key.

Only the PF keys labelled with a function name on the bottom of the screen are enabled.

- PF1 Requests help.
- PF2 Shows the SQL statement text in formatted mode.
- PF3 Terminates list display.
- PF4 If in list mode, takes a hardcopy of the entire list.
If in page mode, takes a hardcopy of the current screen.
- PF5 Invokes the "format" function.

The format function displays all column names in the list, preceded by a + sign if the column is displayed or by a - sign if the column has been hidden previously. You may override the + or - sign in the following manner:

- + Unhides a previously hidden column, i.e. the column will be displayed again.
 - Hides a column so that it is no longer displayed, although it remains in the list.
 - < Sorts the list on this column in ascending sequence (low to high). Only one ordering column can be designated.
 - > Sorts the list on this column in descending sequence (high to low). Only one ordering column can be designated.
 - 2-9 Entering a number from 2 to 9 will move the column to the corresponding position in the list. The column previously on that position will take the position of the column moved.
- PF6 Places the current line on the first line of the list.
 - PF7 Displays the previous page in the list.
 - PF8 Displays the next page in the list.
 - PF9 Makes the first line of the last page in the list current.

PF10 When displaying the list in pagemode, calls the "Search" function which allows to search list columns on their value. Search can be done using the logical operators = ^= > >. Functions are also provided to locate the highest and lowest column value in the list.

When in listmode, moves the display window to the left.

PF11 Moves the display window to the right if the screen capacity does not allow to display the entire list line.

PF12 Swaps the listformat between column and page mode.

In column mode, several table rows are displayed on one screen.
In page mode, only one row is displayed.

ENTER Will make the object on the line pointed to by the cursor to the current object and highlight it. Other functions may operate on the "current object". Pressing ENTER is not required : it is sufficient to place the cursor on the required line and press the function PFkey. On return from the function, the object will be shown as current automatically.

13 Sample DBARS Reporting session

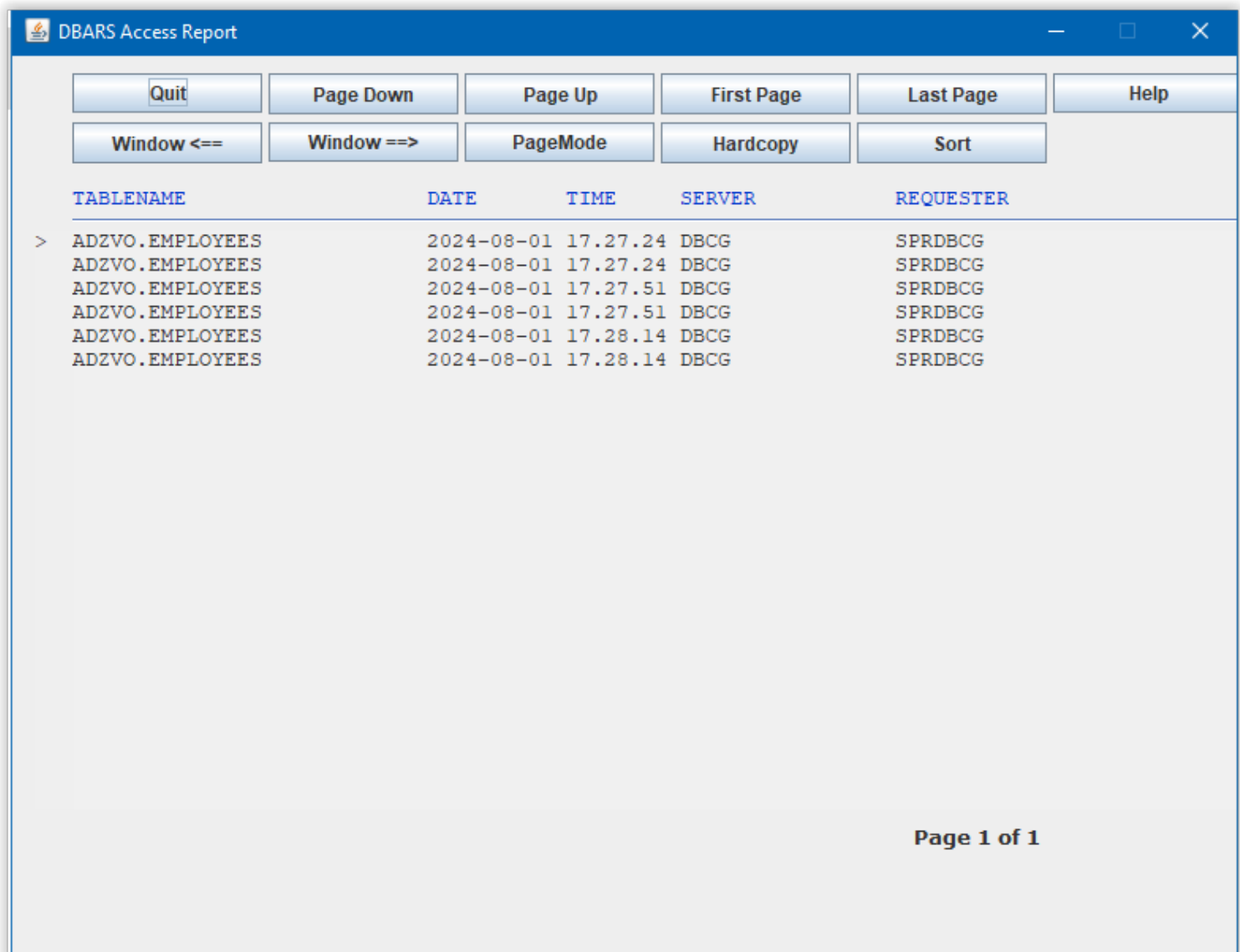
Selection Criteria

The screenshot shows a Windows-style dialog box titled "DBARS Report Criteria". At the top, there are three buttons: "Quit", "Submit", and "Help". Below these are several input fields for selection criteria. The "Recording date" field contains "CURRENT DATE", and the "Table Name" field contains "EMPLOYEES". The "DBARS Region" field contains "DBARS". On the right side of the dialog, there are two buttons: "Select Report" and "Add Report". At the bottom, there is a section labeled "SQL Statement Expressions:" followed by three empty text boxes for entering expressions.

The DBARSGUI program runs on a Windows workstation and is used to examine the audit data recorded by DBARS.

DBARSGUI starts with a criteria selection screen, where we request all accesses to the Employees table, made today.

Selected accesses in list format



The screenshot shows a window titled "DBARS Access Report" with a blue header bar. Below the header is a control panel with buttons for "Quit", "Page Down", "Page Up", "First Page", "Last Page", "Help", "Window <==", "Window ==>", "PageMode", "Hardcopy", and "Sort". The main area contains a table with the following columns: TABLENAME, DATE, TIME, SERVER, and REQUESTER. The table lists six rows of access data for the table ADZVO.EMPLOYEES. At the bottom right of the window, it says "Page 1 of 1".

	TABLENAME	DATE	TIME	SERVER	REQUESTER
>	ADZVO.EMPLOYEES	2024-08-01	17.27.24	DBC	SPRDBC
	ADZVO.EMPLOYEES	2024-08-01	17.27.24	DBC	SPRDBC
	ADZVO.EMPLOYEES	2024-08-01	17.27.51	DBC	SPRDBC
	ADZVO.EMPLOYEES	2024-08-01	17.27.51	DBC	SPRDBC
	ADZVO.EMPLOYEES	2024-08-01	17.28.14	DBC	SPRDBC
	ADZVO.EMPLOYEES	2024-08-01	17.28.14	DBC	SPRDBC

The criteria entered on the selection screen generate a report for the requested Db2 accesses.

Pressing the "PageMode" button in the list will show all details for a particular Db2 access.

Selected access in page format

The screenshot shows a window titled "DBARS PageMode Access Report" with a blue header bar. Below the header is a toolbar with buttons for "Quit", "Page Down", "Page Up", "First Page", "Last Page", "SQLText", "Search", "Copy", and "Help". The main content area displays metadata for a selected access, organized into two columns. The first column lists: **TableName** ADZVO.EMPLOYEES, **Date** 2024-08-01, **Server** DBCG, **Db2 Userid** IBMUSER, **Correlation** IBMUSER, **Program** DSQFFSQ7, **Access** SELECT, **SQLCODE** 0, and **Luw_Id** DF7B555966EE. The second column lists: **Time** 17.28.14, **Requester** SPRDBCG, **z/OS Userid** IBMUSER, **Connection** TSO, **Section** 1, **Dynamic** Y, **Rows Processed** 0, and **External WS**. Below the metadata is a horizontal line, followed by the SQL text: `SELECT * FROM ADZVO.EMPLOYEES WHERE LASTNAME='ADAMSON' FOR FETCH ONLY`. The bottom right corner of the window displays "Page 5 of 6".

Quit	Page Down	Page Up	First Page	Last Page
	SQLText	Search	Copy	Help

TableName ADZVO.EMPLOYEES
Date 2024-08-01
Server DBCG
Db2 Userid IBMUSER
Correlation IBMUSER
Program DSQFFSQ7
Access SELECT
SQLCODE 0
Luw_Id DF7B555966EE

Time 17.28.14
Requester SPRDBCG
z/OS Userid IBMUSER
Connection TSO
Section 1
Dynamic Y
Rows Processed 0
External WS

```
SELECT * FROM ADZVO.EMPLOYEES WHERE LASTNAME='ADAMSON' FOR FETCH ONLY
```

Page 5 of 6

The "PageMode" format shows all the data items recorded by DBARS for the selected access.

14 Batch Access Reporting from the Recorder

The current DBARS Recorder dataset is processed by the batch DBARSRR program. The program provides following functions:

- generate a printed report
- export a VSAM or QSAM Recorder to a Db2 table
- export a VSAM or QSAM Recorder to a sequential output dataset in CSV format

The input Recorder can be:

- a Db2 table (not supported for the EXPORT CSV function)
- a VSAM cluster (the default)
- a sequential QSAM dataset

If a VSAM Recorder is used, the DBARSRR program determines which of the Recorders (RECORDA or RECORDB) is the current one. Therefore, DD statements for both recorders must be supplied.

For a sequential Recorder, the current Recorder is dynamically allocated by the program.

The EXEC DBARSRR statement is followed by:

- one or more *Report control statements* described below.
- a number of *Recorder selection criteria* to define a Recorder subset for processing. The syntax of the selection criteria is described below.

Exporting to a Db2 table

Report control and report selection statements are supplied after a DD SYSIN. When the DBARSRR output chosen is a Db2 table, data from a VSAM or sequential Recorder are imported into a Db2 table. This result table can be:

- the DBARS.RECORDER table created using the DBARSTAB installation job
- a table created previously "LIKE" the DBARS Recorder

Exporting to a CSV file

The CSV export function writes the Recorder (or a subset of it) to a sequential dataset defined on a DD OUTDS statement.

A CSV export is requested using the **EXPORT** and **FIELDS** report control statement.

14.1 Report Control Statements

SSID *xxxx*

Specify the name of the Db2 subsystem where the DBARS Recorder resides. Alternatively, use a *xxxx.SDSNEXIT* DD to identify that subsystem. SSID should be the first statement in the SYSIN stream.

DBARS_JN *nnn*

If the jobname of the DBARS address space is different from "DBARS", specify the jobname in the DBARS_JN statement. If multiple Db2 systems are recorded, you should specify the name of the DBARS region that records the intended Db2 system.

DB2_REC

Specify when the DBARS Recorder is a Db2 table.

SEQREC

Specify the keyword for a VSAM Recorder. This is the default value.

SEQRECS

Specify the keyword for a sequential Recorder.

SAM_PREFIX *nnn*

If the Recorder is a sequential dataset, include the SAM_PREFIX described in [DBARS startup parameters](#).

OUTTABLE *nnn* [APPEND]

The OUTTABLE statement requests report output to the result table named *nnn*. That table should have been created previously by the user. The APPEND option allows to extend an existing report table with a new report. Without APPEND, DBARSRR will delete all rows, if any, from the target result table.

OUTLINES *{nn|66}*

The OUTLINES statement requests a printed report and specifies the number of lines per page.

OUTTABLE and OUTLINES are mutually exclusive. If neither OUTTABLE or OUTLINES is specified, the report will be printed with a linecount of 66.

EXPORT [NOHEADER]

The EXPORT statement requests an export of the Recorder to sequential dataset defined using an OUTDS DD statement. The output records contain the Recorder fields, separated by a semicolon.

The statement cannot be specified for a Db2 Recorder.

By default the first record of the export file contains the names of the exported fields. The NOHEADER option will suppress that record.

FIELDS <fieldname 1> ... <fieldname n>

When no FIELDS are specified for EXPORT, all Recorder fields are stored into OUTDS.

The FIELDS specification allows to export only the named Recorder fields. The FIELDS statement also specifies the order of the exported fields.

The field names should be written as follows:

ACCESS_STAMP

Timestamp of the recorded access

LOCATION

Name of the Db2 subsystem where the recorded statement was executed

TCREATOR

Creator of the recorded table

TNAME

Name of the recorded table

DB2ID

Db2 username

ZOSID

z/OS username

PROGRAM

Name of the program containing the recorded SQL statement

CORRELATION

Name of the process issuing the recorded SQL statement

CONNECTION

Type of the users Db2 connection (BATCH TSO DDF CICS)

LUWID

Identification of the logical unit of work

EXT_SERVER

Name of the Db2 system sending the SQL statement (distributed data access only)

EXT_APPL

Name of the external application sending the SQL statement (distributed data access only)

EXT_WS

Name of the workstation from which the SQL statement was sent (distributed data access only)

SQLCODE

SQLCODE resulting from statement execution

SQLROWS

Number of rows modified by the statement

DYNAMIC

Execution mode of SQL statement (dynamic or static)

STMNT_TEXT

Text of the SQL statement

14.2 Selection Statement Syntax

Recorder selection criteria are coded on SYSIN. They have the following syntax:
variable operator value

- **VARIABLE** names the Recorder field to be tested as follows:

DATE	Date of recorded access (a valid Db2 date expression)
TIME	Time of recorded access (a valid Db2 time expression)
TCREATOR	Creator of the recorded table
TNAME	Name of the recorded table
DB2ID	Db2 userid issuing the recorded SQL statement
ZOSID	z/OS userid issuing the recorded SQL statement
CORRELATION	Name of the process issuing the recorded SQL statement
CONNECTION	Type of the users Db2 connection ('BATCH', 'TSO', ...)
PROGRAM	Name of the program containing the recorded SQL statement
STMTYPE	SQL statement type as SELECT, INSERT, DELETE, UPDATE
SQLCODE	SQLCODE resulting from statement execution
SQLROWS	Number of rows modified by the statement
SERVER	Db2 subsystem where the recorded statement was executed
DYNAMIC	Y will report dynamic SQL statements N will report SQL statements executed in static mode blank will report both static and dynamic statements
EXT_SERVER	Name of the Db2 system sending the SQL statement (distributed data access only)
EXT_APPL	Name of the external application sending the SQL statement (distributed data access only)
EXT_WS	Name of the workstation from which the SQL statement was sent (distributed data access only)

- **OPERATOR** requests the test operation to be performed between "variable" and "value", as follows:

=	to test equal
<	to test lower than
>	to test higher than
<=	to test lower or equal than
>=	to test higher or equal than
<>	to test not equal
LIKE	to perform a generic test using trailing % sign

- **VALUE**

- Alpha values may, but need not, be enclosed in quotes.
- A trailing % sign used with the = operator will act as a LIKE operator.
- Leading zeroes need not be supplied for a column that is logically numerical.
- The elements of the expression may, but need not, be separated by one or more blanks.
- If multiple column expressions are specified, a recorded statement will be reported only when it satisfies all the expressions.
- To test whether a column value is present, use the expression <> ``.
- Db2 date/time expressions may be entered for the DATE and TIME columns. For example : DATE >= CURRENT DATE - 1 MONTH

14.3 Sample JCL

The following JCL will scan the active Recorder and print all Db2 accesses between 2PM and 3PM of the current date.

```
//DBARSRR JOB (...), '...', CLASS=A, MSGCLASS=A,
//          USER=..., PASSWORD=...
//DBARSRR EXEC PGM=DBARSRR
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
//RECORDA DD DSN=DBARS.RECORDER.A, DISP=SHR
//RECORDB DD DSN=DBARS.RECORDER.B, DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSIN   DD *
OUTLINES 44
DATE = CURRENT DATE
TIME = 14.%
/*
```

The following JCL will export the Recorder entries for the current date to the OUTDS dataset, in CSV format. The exported entries will contain the named FIELDS only.

```
//DBARSRR JOB (...), '...', CLASS=A, MSGCLASS=A,
//          USER=..., PASSWORD=...
//DBARSRR EXEC PGM=DBARSRR
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
//RECORDA DD DSN=DBARS.RECORDER.A, DISP=SHR
//RECORDB DD DSN=DBARS.RECORDER.B, DISP=SHR
//OUTDS   DD DSN=DBARS.EXPORTED, DISP=<disposition>
//SYSIN   DD *
EXPORT
FIELDS ACCESS_STAMP DB2ID TCREATOR TNAME
FIELDS CONNECTION PROGRAM STMT_TEXT
DATE = CURRENT DATE
/*
```

15 Exception Reporting

The online Exception Reporting program DBARSXR is used to scan the DBARS EXCEPTIONS table.

DBARSXR is called from a TSO session using the TSO command

```
CALL 'DBARS.LOADLIB(DBARSXR)' ['SSID=xxxx']
```

or using an installation defined ISPF shortcut.

The SSID parameter on the above CALL statement can be used if the TSO session is not implicitly connected to the Db2 subsystem where the DBARS tables reside, that is, if the TSO login procedure does not contain a DD statement for the corresponding SDSNEXIT dataset.

DBARSXR can be invoked only if the TSO terminal has at least 32 lines.

15.1 Entering Report Criteria

At entry into the DBARSXR program, the report selection criteria are requested. Report criteria can be entered for the columns of the Exceptions table.

Enter selection values for one or more of the following table columns:

Recording date	Date of the recorded access (as a valid Db2 date expression)
Recording time	Time of the access (as a valid Db2 time expression)
Exception Code	Exception code stored by the Exception user exit
Table creator	Creator of the table accessed
Table name	Name of the table accessed
Appl server	Name of the Db2 system where the SQL statement was executed
Db2 authid	Db2 userid issuing the recorded SQL statement
z/OS userid	z/OS userid issuing the recorded SQL statement
Correlation name	Name of the process issuing the recorded SQL statement (for example the z/OS job name)
Connection type	Type of the users Db2 connection ('BATCH', 'TSO', ...)
Appl requester	Name of the Db2 system sending the SQL statement
Ext_application	Name of the external application issuing the SQL statement (distributed data access only)
Ext_workstation	Name of the workstation issuing the SQL statement (distributed data access only)

Program name	Name of the program containing the recorded SQL statement
Statement type	Type of the recorded SQL statement as SELECT, INSERT, DELETE or UPDATE
Exception	<p>The reason that caused the SQL access to be stored in the exceptions table:</p> <ul style="list-style-type: none"> • "Alerted" when DBARS issued an alert, based on a DBARS access rule. • "Blocked" when DBARS has blocked statement execution, based on a DBARS access rule. • The numerical value of the returncode passed by a DBARS user exit.
SQLROWS	Number of rows modified by the statement
Location	Name of the Db2 subsystem where the recorded statement was executed
Dynamic SQL	<ul style="list-style-type: none"> • Y will report SQL statements executed in dynamic mode • N will report SQL statements executed in static mode • blank will report both static and dynamic statements
Order by	<p>Insert the column-names or column-numbers for sorting the report. If multiple columns are specified, they should be separated by a comma. The keywords ASC and DESC request an ascending or descending order.</p> <p>For example:</p> <pre>ORDER BY Db2_ID, ACCESS_STAMP DESC</pre> <p><i>or</i></p> <pre>ORDER BY 5, 1 DESC</pre>

Criteria syntax rules:

- Criteria can be entered as a simple value, for example:
TABLE NAME : **CUSTOMER**
- A generic value may be supplied using a trailing % sign, for example:
PROGRAM NAME : **DSQ%**
- Selection criteria may be entered as a Db2 expression, for example:
STATEMENT TYPE : **<> 'SELECT'**
or
RECORDING DATE : **> CURRENT DATE - 2 MONTHS**
- Db2 expressions on recorder table columns are executed using Db2 calls. Therefore, these expressions must obey Db2 syntax rules. All columns of the Recorder table, except SQLCODE and SQLROWS, have the CHARACTER format. Search values entered for CHARACTER columns must be enclosed in quotes.
- When multiple selection values are entered, the Recorder table rows must satisfy all criteria before being selected.

ORDER BY column-names and column-numbers

Column-nr Column-name

1	ACCESS_STAMP
2	DATE(ACCESS_STAMP)
3	TIME(ACCESS_STAMP)
4	EXCEPTION CODE
5	LOCATION
6	DB2_ID
7	MVS_ID
8	CORRELATION
11	TCREATOR
12	TNAME
13	PROGRAM
14	STMNTNR
15	Exception Reason
16	SQLROWS
17	OPCODE
18	DYNAMIC
19	CONNECT_ID
20	LUWID
21	EXT_SERVER
22	EXT_APPL
23	EXT_STATION

15.2 PFkey Assignments on the Report Criteria Screen

- PF1 Displays a help file.
- PF3 Terminates the report program.
- PF5 Recalls the previous report selection parameters⁶
- PF6 Recalls the next report selection parameters

⁶ All report selection parameters are saved into a Db2 table, for the active TSO userid. Up to 32 sets of selection parameters are retained. Using the PF5 and PF6 keys, the user can browse these saved parameter sets.

15.3 Processing the Access Report

When the report criteria have been entered, DBARSXR extracts the requested rows from the Exceptions table into a list and displays the first page of that list on the terminal.

Program Function keys (PFkeys) are used to process the report list. Some of the PFkeys operate on the "current row", that is the row on the line pointed to by the cursor. To execute these functions, move the cursor to the line showing the object and press the corresponding PF key.

Only the PF keys labelled with a function name on the bottom of the screen are enabled.

- PF1 Requests help.
- PF2 Shows the SQL statement text in formatted mode.
- PF3 Terminates list display.
- PF4 If in list mode, takes a hardcopy of the entire list.
If in page mode, takes a hardcopy of the current screen.
- PF5 Invokes the "format" function.

The format function displays all column names in the list, preceded by a + sign if the column is displayed or by a - sign if the column has been hidden previously. You may override the + or - sign in the following manner:

- + Unhides a previously hidden column, i.e. the column will be displayed again.
 - Hides a column so that it is no longer displayed, although it remains in the list.
 - < Sorts the list on this column in ascending sequence (low to high). Only one ordering column can be designated.
 - > Sorts the list on this column in descending sequence. Only one ordering column can be designated.
 - 2-9 Entering a number from 2 to 9 will move the column to the corresponding position in the list. The column previously on that position will take the position of the column moved.
- PF6 Places the current line on the first line of the list.
 - PF7 Displays the previous page in the list.
 - PF8 Displays the next page in the list.
 - PF9 Makes the first line of the last page in the list current.

PF10 When displaying the list in pagemode, calls the "Search" function which allows to search list columns on their value. Search can be done using the logical operators = ^= > >. Functions are also provided to locate the highest and lowest column value in the list.

When in listmode, moves the display window to the left.

PF11 Moves the display window to the right if the screen capacity does not allow to display the entire list line.

PF12 Swaps the listformat between column and page mode.

In column mode, several table rows are displayed on one screen. In page mode, only one row is displayed.

ENTER Will make the object on the line pointed to by the cursor to the current object and highlight it. Other functions may operate on the "current object". Pressing ENTER is not required : it is sufficient to place the cursor on the required line and press the function PFkey. On return from the function, the object will be shown as current automatically.

16 Archiving the DBARS Recorder

Archiving the Recorder is typically done by a user procedure that is automatically scheduled, for example during end-of-day processing. The frequency of archiving depends on the size of the online Recorder and on the number of Db2 accesses actually recorded.

The DBARS archive can be kept on disk or on [virtual] tape. **The archive should be a cataloged dataset.**

Archiving is done by the DBARSA program, which transfers the Recorder to a sequential dataset (identified by the ARCHIVE DD) or to a Db2 table.

16.1 KEEP Statement

The KEEP statement is used only with a Recorder on a Db2 table. KEEP is entered in the PARM field of the EXEC DBARSA statement. If the KEEP statement is omitted, all Recorder rows are transferred to the archive. This is the default archiving strategy.

Syntax:

```
KEEP n {DAY(S)|MONTH(S)|YEAR(S)} [NOPURGE]
```

The KEEP operand states how many recorder rows must be kept in the Recorder table, for example: 6 MONTHS, 1 YEAR. The remaining rows are exported to the Archive.

The KEEP specification is used to build the WHERE clause on the Recorder SELECT and DELETE statements issued by DBARSA:

```
WHERE DATE(ACCESS_STAMP) <= CURRENT DATE - (KEEP_specification)
```

The NOPURGE operand states that the Recorder rows should be written to the Archive without being deleted from the Recorder table.

16.2 JOBNAME Statement

The statement is used only with a Recorder on a Db2 table. JOBNAME is entered in the PARM field of the EXEC DBARSA statement.

Syntax:

```
JOBNAME <name of the DBARS started task>
```

16.3 SEQREC[S] statement

The SEQREC statement indicates that the Recorder is a VSAM cluster. The SEQRECS statement indicates that the Recorder is a sequential dataset. The SEQREC[S] statement is entered in the PARM field of the EXEC DBARSA statement.

Syntax:

```
SEQREC JOBNAME <Jobname>  
      [RESTART YES|NO]  
      [TABLE <owner.name>]  
      [RECID A|B]
```

```
SEQRECS JOBNAME <Jobname>  
      SAM_PREFIX <prefix>  
      [RESTART YES]  
      [TABLE <owner.name>]  
      [RECID A|B]
```

- JOBNAME specifies the name of the DBARS started task. If the Centralized Recorder should be archived, enter the name of the DBARSCRS task or its jobname.
- For a sequential Recorder (SEQRECS) specify the SAM_PREFIX as described in [DBARS startup parameters](#).
- When the previous archive run did not complete normally, the RESTART argument must be supplied.
 - RESTART YES should be specified to continue archiving the recorder being processed when the abend occurred.
 - RESTART NO should be specified only when it is not possible to resume the archive.

The restart argument is ignored when the previous archive run was successful.

- The TABLE keyword allows to archive the Recorder to a named Db2 table. This table should have been created previously LIKE the DBARS Recorder table. The archive table can be processed using the DBARSIR program, as described earlier in the paragraph describing program .
- The RECID keyword allows to explicitly archive a named Recorder. This facility should only be used in an automated archive procedure, described in [Automated Recorder Archiving](#). In all other cases, DBARSA will determine the current Recorder and archive it.

Notes:

1. Unless archiving is from a Db2 table, DD statements must be provided for both RECORDA and RECORDB.
2. Unless archiving is to a Db2 table, a DD statement must be provided for the ARCHIVE dataset.
3. The DBARS distribution file provides the member DBARS\JCL\DBARSCAT with a sample JCL stream to create a DBARS archive table.
4. The archive program automatically determines the current recorder cluster to be archived. During archiving, recording continues on the alternate cluster.

16.4 Coding the ARCHIVE DD

The disposition of the ARCHIVE dataset and the physical volume specifications are the responsibility of the user.

If a recorder archive is kept for a given period (a quarter for example), a DISP=(NEW,CATLG) should be specified at the begin of the period. Within the archiving period, a DISP=MOD could be used to extend the current archive volume.

16.5 Archive a Db2 Recorder to disk or tape

```
//DBARSA      JOB (xxxxx), 'xxx', REGION=4M, CLASS=A, MSGCLASS=A,
//            USER=xxxxx, PASSWORD=xxxxx
//DBARSA      EXEC PGM=DBARSA, PARM='JOBNAME xxx'
//ARCHIVE     DD DSN=DBARS.ARCHIVE, DISP=(MOD), UNIT=SYSDA
//STEPLIB     DD DSN=DBARS.LOADLIB, DISP=SHARE
//SYSPRINT    DD SYSOUT=A
//SYSUDUMP    DD SYSOUT=A
```

16.6 Archive a VSAM Recorder to disk or tape

```
//DBARSA      JOB (xxxxx), 'xxx', REGION=4M, CLASS=A, MSGCLASS=A,
//            USER=xxxxx, PASSWORD=xxxxx
//DBARSA      EXEC PGM=DBARSA, PARM='SEQREC JOBNAME xxx'
//ARCHIVE     DD DSN=DBARS.ARCHIVE, DISP=(MOD), UNIT=SYSDA
//RECORDA     DD DSN=DBARS.RECORDER.A, DISP=SHR
//RECORDB     DD DSN=DBARS.RECORDER.B, DISP=SHR
//STEPLIB     DD DSN=DBARS.LOADLIB, DISP=SHARE
//SYSPRINT    DD SYSOUT=A
//SYSUDUMP    DD SYSOUT=A
```

16.7 Archive a VSAM Recorder to a Db2 table

```
//DBARSA      JOB (xxxxx), 'xxx', REGION=4M, CLASS=A, MSGCLASS=A,
//            USER=xxxxx, PASSWORD=xxxxx
//DBARSA      EXEC PGM=DBARSA, PARM='SEQREC JOBNAME xxx TABLE xxx'
//RECORDA     DD DSN=DBARS.RECORDER.A, DISP=SHR
//RECORDB     DD DSN=DBARS.RECORDER.B, DISP=SHR
//STEPLIB     DD DSN=DBARS.LOADLIB, DISP=SHARE
//SYSPRINT    DD SYSOUT=A
//SYSUDUMP    DD SYSOUT=A
```


16.8 Combined Recorder Archiving

When the Recorder has been defined as a VSAM cluster, it can be archived frequently to the DBARS.RECORDER table, using the SEQREC TABLE option.

The DBARS.RECORDER table can then be used for fast Recorder access, using the DBARSIR program.

The DBARS.RECORDER can be archived to a sequential dataset using the KEEP option of the DBARSA program.

17 Automated Recorder Archiving

When the ARCHIVE_PROC statement (see [DBARS startup parameters](#)) has been coded in the DBARS startup parameters, the Recorder will be archived automatically when the Recorder is full. During archiving audit data are stored into the alternate Recorder. The cataloged archive procedure supplies the same JCL and control parameters as the manual archive, described above.

Chapter [4.3 Procedure to archive a VSAM Recorder](#) and [4.4 Procedure to archive a BSAM Recorder](#) provide sample archiving procedures. These procedures are intended to be invoked by DBARS, when recording switching is needed.

The archive should be a cataloged dataset.

18 Interactive reporting from an Archive

Interactive reporting from a DBARS archive is called from a TSO session using the TSO command:

```
CALL 'DBARS.LOADLIB(DBARSRRI)' 'ARCHIVE'
```

or using an installation defined ISPF shortcut.

When the DBARSRRI program starts, the standard selection criteria screen is displayed, as described in [Entering report selection criteria](#).

The field Recording Date is required for Archive reporting. The date (which may be generic), will be used to locate the DBARS archive dataset containing the desired archived data. The DBARS **Archive_Catalog** table is used to retrieve the name of the archive dataset for the specified period. Other selection criteria may be specified as well.

Example

The following selection criteria will show all accesses to the Customers table made by user XYZ in September 2019, as recorded in the corresponding DBARS archive dataset.

Recording Date	2019-09-%
Db2 authid	XYZ
Table name	CUSTOMERS

The resulting report is managed as described in [Processing the Access Report](#).

Note

DBARS archive datasets usually reside on offline media, such as [virtual] tape. Mounting such dataset may require some time.

19 Batch reporting from an Archive

The DBARS archive dataset, identified by the DD ARCHIVE, is processed by the DBARSAR program, to generate:

- a printed report
- a result Db2 table
- a sequential dataset in CSV format

The result table should be a Db2 table created previously with a table structure identical to that of the DBARS Recorder (created "LIKE"). After the reporting run, the result table can be displayed using interactive DBARS reporting. It is possible to use the DBARS.RECORDER table as OUTTABLE.

The CSV export function writes the Recorder (or a subset of it) to a sequential dataset defined on a DD OUTDS statement. A CSV export is requested using the **EXPORT** and **FIELDS** report control statement.

Report control and report selection statements are supplied after a DD SYSIN.

19.1 Report Control Statements

SSID *xxxx*

Specify the name of the Db2 subsystem where the DBARS Recorder resides. Alternatively, use a *xxxx.SDSNEXIT* DD to identify that subsystem. SSID should be the first statement in the SYSIN stream.

OUTTABLE *nnn* [APPEND]

The OUTTABLE statement requests archive report output to the result table named *nnn*. That table should have been created previously by the user. The APPEND option allows to extend an existing report table with a new report. Without APPEND, DBARSAR will delete all rows, if any, from the target result table.

OUTLINES {*nn*|66}

The OUTLINES statement requests a printed archive report and specifies the number of lines per page.

OUTTABLE and OUTLINES are mutually exclusive. If neither OUTTABLE or OUTLINES is specified, the archive report will be printed with a linecount of 66.

EXPORT [NOHEADER]

The EXPORT statement requests an export of the Recorder to sequential dataset defined using an OUTDS DD statement. The output records contain the Recorder fields, separated by a semicolon.

By default the first record of the export file contains the names of the exported fields. The NOHEADER option will suppress that record.

FIELDS <fieldname 1> ... <fieldname n>

When no FIELDS are specified for EXPORT, all Recorder fields are stored into OUTDS.

The FIELDS specification allows to export only the named Recorder fields. The FIELDS statement also specifies the order of the exported fields.

The field names should be written as follows:

ACCESS_STAMP
Timestamp of the recorded access

LOCATION
Name of the Db2 subsystem where the recorded statement was executed

TCREATOR
Creator of the recorded table

TNAME
Name of the recorded table

DB2ID
Db2 username

ZOSID
z/OS username

PROGRAM
Name of the program containing the recorded SQL statement

CORRELATION
Name of the process issuing the recorded SQL statement

CONNECTION
Type of the users Db2 connection (BATCH TSO DDF CICS)

LUWID
Identification of the logical unit of work

EXT_SERVER
Name of the Db2 system sending the SQL statement(distributed data access only)

EXT_APPL
Name of the external application sending the SQL statement (distributed data access only)

EXT_WS
Name of the workstation from which the SQL statement was sent (distributed data access only)

SQLCODE
SQLCODE resulting from statement execution

SQLROWS
Number of rows modified by the statement

DYNAMIC
Execution mode of SQL statement (dynamic or static)

STMNT_TEXT
Text of the SQL statement

19.2 Selection Statement Syntax

Archive selection criteria are coded on SYSIN. They have the following syntax:
variable operator value

- **VARIABLE** names the Recorder field to be tested as follows:

DATE	Date of recorded access (a valid Db2 date expression)
TIME	Time of recorded access (a valid Db2 time expression)
TCREATOR	Creator of the recorded table
TNAME	Name of the recorded table
DB2ID	Db2 userid issuing the recorded SQL statement
ZOSID	z/OS userid issuing the recorded SQL statement
CORRELATION	Name of the process issuing the recorded SQL statement
CONNECTION	Type of the users Db2 connection ('BATCH', 'TSO', ...)
PROGRAM	Name of the program containing the recorded SQL statement
STMTYPE	SQL statement type as SELECT, INSERT, DELETE, UPDATE
SQLCODE	SQLCODE resulting from statement execution
SQLROWS	Number of rows modified by the statement
SERVER	Db2 subsystem where the recorded statement was executed
DYNAMIC	Y will report SQL statements executed in dynamic mode N will report SQL statements executed in static mode blank will report both static and dynamic statements
EXT_SERVER	Name of the Db2 system sending the SQL statement (distributed data access only)
EXT_APPL	Name of the external application sending the SQL statement (distributed data access only)
EXT_WS	Name of the workstation from which the SQL statement was sent (distributed data access only)

- **OPERATOR** requests the test operation to be performed between "variable" and "value", as follows:

=	to test equal
<	to test lower than
>	to test higher than
<=	to test lower or equal than
>=	to test higher or equal than
<>	to test not equal
LIKE	to perform a generic test using trailing % sign

- **VALUE**

- Alpha values may, but need not, be enclosed in quotes.
- Db2 date/time expressions may be entered for the DATE and TIME columns. For example : DATE >= CURRENT DATE - 1 MONTH
- A trailing % sign used with the = operator will act as a LIKE operator.
- Leading zeroes need not be supplied for a column that is logically numerical.
- The elements of the expression may, but need not, be separated by one or more blanks.
- If multiple column expressions are specified, a recorded statement will be reported only when it satisfies all the expressions.
- To test whether a column value is present, use the expression <> ` `.

19.3 Sample JCL

```
//DBARSAR      JOB (...), '...', REGION=4M, CLASS=A, MSGCLASS=A,
//              USER=..., PASSWORD=...
//DBARSAR      EXEC PGM=DBARSAR
//STEPLIB      DD DSN=DBARS.LOADLIB, DISP=SHARE
//ARCHIVE      DD DSN=DBARS.ARCHIVE.Y2019.Q4, DISP=OLD
//SYSPRINT     DD SYSOUT=A
//SYSUDUMP     DD SYSOUT=A
//SYSIN        DD *
DATE = 2021-10-11
DB2ID = U1234
TNAME = CUSTOMERS
STMTYPE = UPDATE
/*
```

The above JCL will scan the archive and print all updates of the customer table by the named user on the specified date.

The following JCL will export the archived Recorder entries for the specified criteria to the OUTDS dataset, in CSV format. The exported entries will contain the named FIELDS only.

```
//DBARSAR      JOB (...), '...', CLASS=A, MSGCLASS=A,
//              USER=..., PASSWORD=...
//DBARSAR      EXEC PGM=DBARSAR
//STEPLIB      DD DSN=DBARS.LOADLIB, DISP=SHR
//RECORDA      DD DSN=DBARS.RECORDER.A, DISP=SHR
//RECORDB      DD DSN=DBARS.RECORDER.B, DISP=SHR
//OUTDS        DD DSN=DBARS.EXPORTED, DISP=<disposition>
//SYSIN        DD *
EXPORT
FIELDS ACCESS_STAMP DB2ID TCREATOR TNAME
FIELDS CONNECTION PROGRAM STMT_TEXT
DATE = 2021-10-11
DB2ID = U1234
TNAME = CUSTOMERS
STMTYPE = UPDATE
/*
```

20 Importing from an Archive into a Db2 table

DBARS Recorder entries previously archived, can be imported into a Db2 table created by the user. This table may subsequently be used by the interactive DBARS reporting components.

The import result table should be created "LIKE DBARS.RECORDER".

```
CREATE TABLE <table> LIKE DBARS.RECORDER IN database.tablespace
CREATE INDEX <table_i1> ON <table>(ACCESS_STAMP)
```

Specify the name of the table to be loaded from the archive as OUTTABLE.

Please refer to [Reporting from a DBARS Archive](#) for details on the archive selection parameters.

Sample import JCL

```
//DBARSAR      JOB (.....), '...', REGION=4M, CLASS=A, MSGCLASS=A,
//              USER=....., PASSWORD=.....
//DBARSAR      EXEC PGM=DBARSAR
//STEPLIB      DD DSN=DBARS.LOADLIB, DISP=SHARE
//ARCHIVE      DD DSN=DBARS.ARCHIVE.Y2019, DISP=OLD
//SYSPRINT     DD SYSOUT=A
//SYSUDUMP     DD SYSOUT=A
//SYSIN        DD *
OUTTABLE <creator.tablename>
DATE = 2019-10-11
DB2ID = U1234
TNAME = CUSTOMERS
STMTYPE = UPDATE
/*
```

The above JCL will import from the named archive into the target Db2 table, all updates of the customer table by the named user on the specified date.

21 Writing a DBARS User Exit

A DBARS user exit is declared with an EXIT statement in the EXECPARM member of the DBARS JCLLIB. The user exit is written in REXX and called by the DBARS Writer task before the access is stored in the Recorder table.

The exit runs under the DBARS userid. At entry, there is a connection to the Db2 system that holds the DBARS Recorder table. The exit may perform any necessary action including SQL access. However, if SQL statements are issued, a COMMIT should be used before returning to DBARS.

Following arguments are passed to the exit:

Argument Number	Argument Content	Argument Length
1	Access timestamp	26
2	TCB address	8
3	Name of Db2 application server	16
4	Db2 userid	8
5	z/OS userid	8
6	Correlation name	12
7	Connection type	8
8	LUW_id	12
9	External Server Name	16
10	External Application Name	32
11	External Workstation Name	18
12	RDI Call Type	4
13	RDI Statement Type	4
14	Table Creator	8
15	Table Name	128
16	Program Name	8
17	Program Section number	4
18	SQLCODE	8
19	Number of rows processed	16
20	Operation Code	8
21	Dynamic access flag	1
22	Length of SQL Statement_text	8
23	Pointer to SQL Statement_text	8

The exit may pass a returncode 8 to bypass the recording of the SQL statement. Exiting with a returncode other than 8, will record the statement.

DBARS Sample User Exit

```
/* Sample DBARS User Exit */
```

```
Arg Stamp ,  
TCB ,  
Db2_server ,  
Db2_userid ,  
zOS_userid ,  
Correlation ,  
Connection ,  
LUWid ,  
External_Server ,  
External_Application ,  
External_Workstation ,  
RDI_Call_Type ,  
RDI_Statement_Type ,  
Table_Creator ,  
Table_Name ,  
Program_Name ,  
Program_Section ,  
SQLCODE ,  
Rows_modified ,  
Operation ,  
Dynamic_access ,  
Length_SQL_Statement ,  
SQL_Statement ,  
.
```

```
/* Display all input arguments, except statement text */
```

```
Say Stamp TCB Db2_server Db2_userid zOS_userid Correlation Connection  
Say LUWid External_Server External_Application External_Workstation  
Say RDI_Call_Type RDI_Statement_Type Table_Creator Table_Name  
Say Program_Name Program_Section SQLCODE Rows_processed Operation
```

```
/* Display the SQL statement text */
```

```
Say STORAGE(SQL_Statement,Length_SQL_Statement)
```

```
Exit 0
```

22 Writing a compiled DBARS User Exit

A compiled DBARS user exit is declared with an EXITMOD statement in the EXECPARM member of the DBARS JCLLIB, as described in [DBARS startup parameters](#).

The exit load module is invoked by the DBARS Writer before storing the audit record to the DBARS Recorder. It is assumed that the exit is written in Assembler.

On entry to the exit, following general registers have been setup:

Register 0	address a workarea, described later in this section
Register 1	address a parameter list, described later in this section
Register 13	address of a 72-byte register savearea, for use by the exit
Register 14	return address to the DBARS Writer
Register 15	entrypoint address of the exit

When DBARS is stopped, the exit is invoked with binary zeroes in Register 1.

When the exit returns to DBARS, a returncode should be specified in register 15.

If register 15 is non-zero, the current audit record is not written to the Recorder.
If register 15 is zero, the current audit record is written to the Recorder.

Format of the parameterlist

- Address of the current audit record
- Up to 8 addresses of optional parameters specified on the EXITMOD startup statement

Format of the exit workarea

- 4 double-words for use by the exit. The area is set to binary zeroes when the exit is called for the first time.
- The 8-byte current DBARS version number as:
Version_nr**R**elease_nr**M**odification_nr

Format of the audit record passed

IN_RECORD	DSECT	
STAMP	DS CL26	;EXECUTION TIMESTAMP
INSERT_STAMP	DS CL26	;RECORDING TIMESTAMP
TCB	DS F	;ALLIED TCB ADDRESS
LOCATION	DS CL16	;Db2 SUBSYSTEM
X_DB2ID	DS CL8	;USER Db2 ID
X_MVSIID	DS CL8	;USER Z/OS ID
TABLE_CREATOR	DS CL8	;CREATOR OF TABLE ACCESSED
TABLE_NAME	DS CL64	;NAME OF TABLE ACCESSED
CORRELATION	DS CL12	;CORRELATION (EG JOBNAME)
X_RDIPROGN	DS CL8	;PROGRAM NAME
X_RDISECTN	DS H	;PROGRAM SECTION NUMBER
X_RDICTYPE	DS H	;Db2 CALL TYPE
X_RDISTYPE	DS H	;Db2 STATEMENT TYPE
X_SQLCODE	DS F	;SQLCODE
X_SQLROWS	DS F	;SQLROWS
STMTYPE	DS CL8	;EXTERNALIZED STATEMENT TYPE
DYNAMIC	DS CL1	;Y IF DYNAMIC STATEMENT
CONNECTION	DS CL8	;CONNECTION (CICS, TSO, DDF, BATCH)
LUWID	DS CL12	;LUWID
EXT_SERVER	DS CL16	;EXTERNAL SERVER IP-ADDRESS
EXT_APPL	DS CL32	;EXTERNAL APPLICATION
EXT_WS	DS CL18	;EXTERNAL WORKSTATION NAME
STMNT_TEXT	DC CL1 ' '	;ALIGNMENT FOR STMNT_TEXT
STMNT_TEXT	DS H,CL30720	;STATEMENT TEXT

Sample EXITMOD

```
EXITMOD      START      0
             STM        R14,R12,12(R13) ;SAVE DBARS REGISTERS
             LR         R3,R15
             USING     EXITMOD,R3      ;ADDRESSABILITY FOR EXITMOD
             LA         R15,SAVEAREA   ;GET A LOCAL SAVEAREA
             ST         R13,4(,R15)    ;CHAIN TO DBARS SAVEAREA
             LR         R13,R15
             LTR        R1,R1
             JZ         DBARS_RET      ;BR IF DBARS IS BEING STOPPED
*
             L         R4,0(,R1)       ;ADDRESS AUDIT RECORD
             USING     INREC,R4
             LR         R10,R0         ;ADDRESS WORKAREA
             USING     WORK,R10
*
*                                           ;PROCESS INREC DATA
*
DBARS_RET    DS         0H
             L         R13,4(,R13)    ;BACKCHAIN TO DBARS SAVEAREA
             LM        R14,R12,12(R13) ;RELOAD DBARS REGISTERS
             XR        R15,R15        ;RC = WRITE AUDIT RECORD
             BR         R14           ;RETURN TO DBARS
*
SAVEAREA     DS         9D
R0           EQU       0              ;REGISTER EQUATES
R1           EQU       1
R2           EQU       2
R3           EQU       3
R4           EQU       4
R5           EQU       5
R6           EQU       6
R7           EQU       7
R8           EQU       8
R9           EQU       9
R10          EQU       10
R11          EQU       11
R12          EQU       12
R13          EQU       13
R14          EQU       14
R15          EQU       15
*
```

```

INREC          DSECT
STAMP          DS  CL26          ;EXECUTION TIMESTAMP
INSERT_STAMP  DS  CL26          ;RECORDING TIMESTAMP
TCB            DS  F             ;ALLIED TCB ADDRESS
LOCATION        DS  CL16          ;Db2 SUBSYSTEM
X_DB2ID       DS  CL8           ;USER Db2 ID
X_MVSIID      DS  CL8           ;USER Z/OS ID
TABLE_CREATOR DS  CL8           ;CREATOR OF TABLE ACCESSED
TABLE_NAME    DS  CL64          ;NAME OF TABLE ACCESSED
CORRELATION   DS  CL12          ;CORRELATION (EG JOBNAME)
X_RDIPROGN    DS  CL8           ;PROGRAM NAME
X_RDISECTN    DS  H             ;PROGRAM SECTION NUMBER
X_RDICTYPE    DS  H             ;Db2 CALL TYPE
X_RDISTYPE    DS  H             ;Db2 STATEMENT TYPE
X_SQLCODE     DS  F             ;SQLCODE
X_SQLROWS     DS  F             ;SQLROWS
STMTYPE       DS  CL8           ;EXTERNALIZED STATEMENT TYPE
DYNAMIC       DS  CL1           ;Y IF DYNAMIC STATEMENT
CONNECTION    DS  CL8           ;CONNECTION (CICS, TSO, DDF, BATCH)
LUWID         DS  CL12          ;LUWID
EXT_SERVER    DS  CL16          ;EXTERNAL SERVER IP-ADDRESS
EXT_APPL      DS  CL32          ;EXTERNAL APPLICATION
EXT_WS        DS  CL18          ;EXTERNAL WORKSTATION NAME
              DS  CL1' '        ;ALIGNMENT FOR STMT_TEXT
STMT_TEXT     DS  H,CL30720     ;STATEMENT TEXTINREC
*
*
WORK          DSECT
USER_WORK     DS  4D            ;FOR USE BY EXIT
DBARS_VERSION DS  CL8          ;DBARS VERSION NUMBER
*
*
              END

```

23 Reporting Access Exceptions

An installation may wish to screen all data accesses to audited tables by examining, within a DBARS User Exit, the data captured by DBARS and presented to the Exit as entry arguments.

23.1 Detecting an access exception

Access exceptions may be detected:

- By checking combined values in the exit entry arguments, using REXX statements.

The [Sample Exception Exit](#) uses the arguments **Table_Name** and **Db2_server** to detect remote access to the Customer table.

- By scanning the SQL statement text for occurrence of unusual values in specified table columns. To facilitate SQL text scanning, DBARS provides the DBARSXRI function.

The function is called as follows:

address linkmvs "DBARSXRI SCAN statement expression"

where:

statement

Is the text of the SQL statement received as input.

expression

Is a logical expression specified in Db2 syntax. The expression states a column name and a column value. DBARSXRI will check the INSERT VALUES and the WHERE clauses to detect whether the statement accesses the named column with the named value. If it does, DBARSXRI returns an rc=1. Else rc=0 is returned.

23.2 Signaling an access exception

- An access exception will be stored into the DBARS EXCEPTIONS table, when the exit returns to DBARS with a returncode greater than 12. The returncode is then considered as an exception code and stored in the Exceptions table, along with all other access information passed to the exit as input arguments.
- Furthermore, when an exception is detected, the exit can send a message to the z/OS console or to a designated z/OS userid. This can be done by calling the DBARSXRI function as follows:

address linkmvs "DBARSXRI SEND {userid|CONSOLE} messagetext"

23.3 Notes

- The Exceptions table is always a Db2 table, even when the Recorder is a VSAM cluster or a sequential dataset.
- Storing the access in the Exceptions table does **not** prevent the actual data access. In fact, the access will be recorded in both the Recorder and in the Exceptions table.
- DBARS provides the DBARSXR utility to inspect the Exceptions table in TSO.

23.4 Sample Exception Exit

```
/* REXX */

/*
    If an access is from a remote server, the exit considers as exceptions:

    - update attempts to the customer table
    - accesses to "sensitive" customer numbers

    All exceptions are stored in the DBARS EXCEPTIONS table with the specific
    exception code.

*/

Arg Stamp ,
TCB ,
Db2_server ,
Db2_userid ,
zOS_userid ,
Correlation ,
Connection ,
LUWid ,
External_Server ,
External_Application ,
External_Workstation ,
RDI_Call_Type ,
RDI_Statement_Type ,
Table_Creator ,
Table_Name ,
Program_Name ,
Program_Section ,
SQLCODE ,
Rows_modified ,
Operation ,
Dynamic_access ,
Length_SQL_Statement ,
SQL_Statement ,
.

exception_code = 0
local_Db2 = "LOCDBVA"
statement = STORAGE(SQL_Statement,Length_SQL_Statement)
if Table_Name = "CUSTOMER_TABLE" then do
    if Db2_server <> local_Db2 then do
        if Operation <> "SELECT" then exception_code = 2040
        else do
            expression = "SENSITIVE <> 0"
            address linkmvs "DBARSRXI SCAN statement expression"
            if rc = 1 then exception_code = 2041
        end
    end
end
end
exit exception_code
```

24 Transferring the DBARS Recorder to an external security system

The DBARSFTP component transfers, using FTP, a sequential Recorder to an external security system such as the Oracle AUDIT Vault and Database Firewall©.

The DBARSFTP member in the DBARS JCLLIB provides a model for the DBARSFTP execution JCL.

```
//DBARSFTP JOB (...), '...', CLASS=A, MSGCLASS=A, REGION=0M,
//          USER=..., PASSWORD=...
//*
//FTP      EXEC PGM=DBARSFTP, PARM='ASN=DBARS, INTERVAL=30'
//STEPLIB DD DSN=DBARS.LOADLIB, DISP=SHR
//SYSPRINT DD SYSOUT=A
//SYSTSPRT DD SYSOUT=A
//SYSUDUMP DD SYSOUT=A
//FTPPARMS DD DSN=DBARS.JCLLIB(FTPPARMS), DISP=SHR
```

24.1 DBARSFTP PARM Keywords

ASN=

Specify the name of the DBARS address space that owns the Recorder to be FTP-ed. DBARSFTP uses the address space name to compose the datasetname of the Recorder and to dynamically allocate it.

INTERVAL=

Specify the FTP interval in seconds. In the model JCL, an FTP run would be scheduled every 30 seconds.

SAM_PREFIX=

Specify the SAM_PREFIX as defined in [DBARS startup parameters](#).

EXT=

If the file extension of the remote file is not specified in the FTPPARMS dataset, it can be specified here.

Specify EXT=XML if the transmitted DBARS recorder is in XML format. Alternatively, append .XML to the output filename on the PUT statement in FTPPARMS.

24.2 The FTPPARMS member

The member provides the FTP commands to be used by DBARSFTP.

- The first line specifies the IP-address of the primary FTP server. Multiple IP-addresses can be specified, separated by a blank. The secondary IP-addresses are used when the primary FTP server cannot be reached.
- The second line provides the login userid.
- The third line contains the user password. If the password is preceded by the string PASSWORD=xxx, DBARSFTP will encode the password on its first execution and store the encoded password in the FTPPARMS member.
- The following lines specify the remaining FTP commands. An ASCII - command is usually required.
- The PUT statement should provide the remote filename only. The name of the FTP-ed Recorder will be inserted by DBARSFTP. The remote filename may contain the variable symbols &SDATE and &STIME. These will be - replaced with the current date and time during FTP.
- The QUIT command should be the last line in the member.
- Lines starting with an asterisk are handled as comment lines.

Example

```
102.148.6.5
USER01
PASSWORD=xxxxxx
ASCII
PUT DBARS.AUDIT.RECORDS.D&SDATE.T&STIME
QUIT
```

24.3 DBARSFTP Operation

- DBARSFTP uses the z/OS FTP API. Consequently an OMVS segment must be defined for the application. Superuser privileges are not required.
- When an FTP run starts, DBARSFTP requests a Recorder switch from the DBARS address space. The closed Recorder is then sent to the FTP server.
- DBARSFTP uses the z/OS resource control services to prevent multiple concurrent accesses to the same FTP server.
- To stop DBARSFTP, issue the z/OS command F DBARSFTP,STOP.

24.4 DBARSFTP Error handling

When an error occurs during the FTP session, for instance because none of the FTP servers can be reached, DBARSFTP issues a DBARSFTP90 message and retries the FTP transfer until it is successful. The installation's automation procedures should intercept the DBARSFTP90 message to request a solution for the error situation.

25 Recorder Data Items

ACCESS_STAMP	TIMESTAMP	Timestamp of statement execution
INSERT_STAMP	TIMESTAMP	Timestamp of statement recording
TCB	INTEGER	User's TCB address
LOCATION	CHAR(16)	Name of the Db2 subsystem accessed
DB2_ID	CHAR(8)	Db2 userid performing the statement
MVS_ID	CHAR(8)	z/OS userid performing the statement
CORRELATION	CHAR(12)	Access association (such as jobname)
CONNECT_ID	CHAR(8)	TSO BATCH CICS DDF
LUWID	CHAR(12)	LUW identification
EXT_SERVER	CHAR(16)	Name of external Db2 server (if DDF)
EXT_APPL	CHAR(32)	Name of external application (if DDF)
EXT_STATION	CHAR(18)	Name of workstation (if DDF)
TCREATOR	CHAR(8)	Table creator
TNAME	VARCHAR(128)	Tablename accessed
PROGRAM	CHAR(8)	Name of program issuing the SQL statement
STMNTNR	SMALLINT	Statement number within PROGRAM
CALL_TYPE	SMALLINT	Internal Db2 request identifier
STMT_TYPE	SMALLINT	Internal Db2 request identifier
OPCODE	CHAR(8)	SELECT UPDATE DELETE INSERT
SQLCODE	INTEGER	SQLCODE of the recorded statement
SQLROWS	INTEGER	Number of rows modified by the statement
DYNAMIC	CHAR(1)	Y if a dynamic, N if a static statement
STMNT_TEXT	LONG VARCHAR	Text of the recorded SQL statement

26 Exceptions Table Structure

ACCESS_STAMP	TIMESTAMP	Timestamp of statement execution
INSERT_STAMP	TIMESTAMP	Timestamp of statement recording
EXCEPTION	INTEGER	Exception code passed by the User Exit
LOCATION	CHAR(16)	Name of the Db2 subsystem accessed
DB2_ID	CHAR(8)	Db2 userid performing the statement
MVS_ID	CHAR(8)	z/OS userid performing the statement
CORRELATION	CHAR(12)	Access association (such as jobname)
CONNECT_ID	CHAR(8)	TSO BATCH CICS DDF
LUWID	CHAR(12)	LUW identification
EXT_SERVER	CHAR(16)	Name of external Db2 server (if DDF)
EXT_APPL	CHAR(32)	Name of external application (if DDF)
EXT_STATION	CHAR(18)	Name of workstation (if DDF)
TCREATOR	CHAR(8)	Table creator
TNAME	VARCHAR(128)	Tablename accessed
PROGRAM	CHAR(8)	Name of program issuing the SQL statement
STMNTNR	SMALLINT	Statement number within the PROGRAM
CALL_TYPE	SMALLINT	Internal Db2 request identifier
STMT_TYPE	SMALLINT	Internal Db2 request identifier
OPCODE	CHAR(8)	SELECT UPDATE DELETE INSERT
SQLCODE	INTEGER	SQLCODE of the recorded statement
SQLROWS	INTEGER	Number of rows modified by the statement
DYNAMIC	CHAR(1)	Y if a dynamic, N if a static statement
STMNT_TEXT	LONG VARCHAR	Text of the recorded SQL statement

27 Recorder Record Structure on the DBARS Archive

ACCESS_STAMP	CHAR(26)	Timestamp of statement execution
INSERT_STAMP	CHAR(26)	Timestamp of statement recording
TCB	INTEGER	User's TCB address
LOCATION	CHAR(16)	Name of the Db2 subsystem accessed
DB2_ID	CHAR(8)	Db2 userid performing the statement
MVS_ID	CHAR(8)	z/OS userid performing the statement
TCREATOR	CHAR(8)	Table creator
TNAME	CHAR(64)	Tablename accessed
CORRELATION	CHAR(12)	Access association (such as jobname)
PROGRAM	CHAR(8)	Name of program issuing the SQL statement
STMNTNR	SMALLINT	Statement number within PROGRAM
CALL_TYPE	SMALLINT	Internal Db2 request identifier
STMT_TYPE	SMALLINT	Internal Db2 request identifier
FILLER	CHAR(2)	
SQLCODE	INTEGER	SQLCODE of the recorded statement
SQLROWS	INTEGER	Number of rows modified by the statement
OPCODE	CHAR(8)	SELECT UPDATE DELETE INSERT
DYNAMIC	CHAR(1)	Y if a dynamic, N if a static statement
CONNECT_ID	CHAR(8)	TSO BATCH CICS DDF
LUWID	CHAR(12)	LUW identification
EXT_SERVER	CHAR(16)	Name of external Db2 server (if DDF)
EXT_APPL	CHAR(32)	Name of external application (if DDF)
EXT_STATION	CHAR(18)	Name of workstation (if DDF)
FILLER	CHAR(1)	
L_STMNT_TEXT	SMALLINT	Length of the recorded SQL statement
STMT_TEXT	VARCHAR(30720)	Text of the recorded SQL statement

28 Recorder Record Structure for FTP

ACCESS_STAMP	CHAR(26)	Timestamp of statement execution
INSERT_STAMP	CHAR(26)	Timestamp of statement recording
FILLER	CHAR(4)	
LOCATION	CHAR(16)	Name of the Db2 subsystem accessed
DB2_ID	CHAR(8)	Db2 userid performing the statement
MVS_ID	CHAR(8)	z/OS userid performing the statement
TCREATOR	CHAR(8)	Table creator
TNAME	CHAR(64)	Tablename accessed
CORRELATION	CHAR(12)	Access association (such as jobname)
PROGRAM	CHAR(8)	Name of program issuing the SQL statement
SQLCODE	CHAR(8)	SQLCODE of the recorded statement (left justified)
SQLROWS	CHAR(8)	Number of rows modified by the statement (left justified)
OPCODE	CHAR(8)	SELECT UPDATE DELETE INSERT
DYNAMIC	CHAR(1)	Y if a dynamic, N if a static statement
CONNECT_ID	CHAR(8)	TSO BATCH CICS DDF
LUWID	CHAR(12)	LUW identification
EXT_SERVER	CHAR(16)	Name of external Db2 server (if DDF)
EXT_APPL	CHAR(32)	Name of external application (if DDF)
EXT_STATION	CHAR(18)	Name of workstation (if DDF)
FILLER	CHAR(3)	
STMNT_TEXT	VARCHAR	Text of the recorded SQL statement

29 Recorder Record XML Structure

Tag Name	Description	
A	ACCESS_STAMP	Canonical timestamp of statement execution ⁷
B	INSERT_STAMP	Canonical timestamp of statement recording
C	TCB	z/OS TCB address or zero
D	LOCATION	Name of the Db2 subsystem accessed
E	Db2_ID	Db2 userid performing the statement
F	MVS_ID	z/OS userid performing the statement
G	CORRELATION	Access association (such as jobname)
H	CONNECT_ID	TSO BATCH CICS DDF
I	LUWID	LUW identification
J	EXT_SERVER	IP-address of external Db2 server if DDF Database name if local access
K	EXT_APPL	Name of external application (if DDF)
L	EXT_STATION	Name of workstation (if DDF)
M	TCREATOR	Table creator
N	TNAME	Tablename accessed
O	PROGRAM	Name of program issuing the SQL statement
P	SECTION	Statement number within program
Q	CTYPE	Internal Db2 command type
R	STYPE	Internal Db2 statement type
S	OPCODE	SELECT UPDATE DELETE INSERT
T	SQLCODE	SQLCODE of the recorded statement
U	SQLROWS	Number of rows modified by the statement
V	DYNAMIC	Y if a dynamic, N if a static statement
W	STMNT_TEXT	Text of the recorded SQL statement

⁷ The format of the canonical timestamp is as follows :

yyyy-mm-ddThh:mm:ss.xxxTZ

where

xxx = the number of milliseconds

TZ = signed timezone in hhmm format

30 DBARS Messages

30.1 Messages issued by the DBARS Main task

DBARS00I	Default Db2 subsystem is <i>nnnn</i> The current DSNHDECP member points to the named Db2 subsystem or a Db2_SUBSYS parameter has been specified. DBARS will connect to this subsystem.
DBARS01I	Recording enabled for Server <i>nnn</i> The message indicates that all audited accesses to the named Db2 server will be recorded.
DBARS02I	Waiting on Db2 subsystem The message indicates that the Db2 server whose accesses must be recorded, is not active. DBARS waits until the Db2 server has been started. This message is more likely to appear when DBARS is started during z/OS IPL.
DBARS03I	<i>n</i> Db2 objects selected for recording. The message shows the number of objects that will be recorded because they relate to audited tables.
DBARS04I	Current startup parameters using member xxxxxxxx: The message shows the DBARS execution parameters obtained using the system defaults and the specifications of the DBARS startup member. This member resides in the DBARS.JCLLIB. The name of the member defaults to EXEC Parm, but can be specified in a PARM operand of the EXEC DBARS JCL statement.
DBARS05I	Initiator loaded at nnnnnnnn The message shows the load address of the DBARS Initiator function.
DBARS06I	Writer task active The message indicates that the DBARS Writer function has been started.
DBARS07I	STOP request has been queued The message is issued after a DBARS STOP command has been submitted. DBARS shutdown will start as soon as all recorded information has been written to the RECORDER table.
DBARS08I	DBARS shutdown started The message is issued when DBARS shutdown starts.

DBARS10I	DBARS Version v.r ModLevel <i>nnnn</i> Version number, release number and modification level of the DBARS software being loaded.
DBARS11A	<i>nnn</i> Address Space not found The named Db2 database address space is not active. The name of this address space is supplied in the Db2_ADDRSPACE parameter of the DBARS EXEC Parm, or is defaulted to <subsystem>DBM1. Action: Find the name of the Db2 database address space and supply it in the EXEC Parm.
DBARS12A	RC= <i>nn</i> during license check An error occurred when verifying the DBARS software license key. Another message will explain the license problem. Action: Contact SPR Software Support to obtain a valid license key.
DBARS13A	DBARS License key has expired The DBARS evaluation period has expired.
DBARS14A	DBARS License key not found The license key (member SCF in DBARS.JCLLIB) was not found.
DBARS15A	DBARS not licensed for CPU-id <i>nnnnn</i> The license key was not built for the named CPU-id.
DBARS16A	DBARS License key has no valid content The license key seems corrupted.
DBARS17I	DBARS License Info:
DBARS18I	Machine-type <i>nnnn</i> CPU-id <i>nnnnn</i>
DBARS19I	Customer Name <i>nnn</i>
DBARS20I	Software key expires on <i>yyyy-mm-01</i> Messages DBARS17I to DBARS20I are informational and describe the current DBARS license key. Message DBARS20I is issued for evaluation licenses only.
DBARS21I	Maxlength of recorded SQL statement is nK The message shows the maximum length of the SQL statements in the RECORDER table. This maximum depends on the bufferpool where the DBARS tablespace is located.

DBARS23A	<p>Rule syntax error</p> <p>The message is preceded by the rule that has the syntax error. Other rules are still acted upon.</p>
DBARS90A	<p>Startup parameter syntax error</p> <p>An syntax error has been detected in the DBARS startup parameters. DBARS startup is terminated.</p>
DBARS91A	<p>Parameter no longer required</p> <p>The specified startup parameter was valid in a previous DBARS version, but is no longer required in the current release. The parameter is accepted for compatibility reasons but effectively ignored. DBARS startup continues.</p>
DBARS92A	<p>DBARS92A GETSHARED Failure RC=x Reason=xxxxxxx DBARS92A SHAREMEMOBJ Failure RC=x Reason=xxxxxxx DBARS92A DETACH Failure RC=x Reason=xxxxxxx</p> <p>Ensure that MEMLIMIT has been specified in the DBARS startup JCL. If MEMLIMIT is specified, call for software support. A description of the Reason code can be found in the IBM Manual "System Codes" under system code DC2.</p>
DBARS97A	<p>DBARSERT component NOT installed.</p> <p>An error occurred when installing the DBARS to Db2 interface.</p> <p>Contact SPR software support.</p>
DBARS98A	<p>DBARS already active</p> <p>An attempt was made to start DBARS more than once in the same z/OS system.</p>
DBARS99A	<p>APF Authorization failure</p> <p>The DBARS.LOADLIB is not an APF-authorized library.</p>
DBARS100A	<p>DBARSCRS job not started.</p> <p>The CRS <jobname> statement was supplied but the DBARSCRS job was not started.</p>
DBARS101A	<p>DBARSCRS on IP_address <n> port <n> cannot be reached.</p> <p>The CRS <IP_address> statement was supplied but the DBARSCRS job was not started or the IP_address or port do not match.</p>

30.2 Messages issued by the DBARS Initiator

DBARSI001I	DBARS Initiator is initializing Initialization of the DBARS Initiator in the DBM1 address space is in progress.
DBARSI997A	DBARS Initiator recovery has been entered A cancel condition has been detected during DBARS processing. Problem determination information has been stored to the DBARS trace buffer. DBARS processing continues. To print the trace buffers, stop DBARS and contact DBARS software support.
DBARSI998A	RC xx requesting Recorder storage Returncode xx was returned by the DBARS storage manager when attempting to obtain storage from the 64-bit buffer area. If the RC equals 8, increase the MEMLIMIT value and restart DBARS.
DBARSI999A	DBARS Initiator disabled. A severe error condition exists which does not allow DBARS recording to continue. Another message will precede and explain the error condition.

30.3 Messages issued by the DBARS Queue Manager

DBARSM01A	<p>Recorder queue space full. Recording disabled until queue space becomes available..</p> <p>The recorder queue space in the DBARS address space has no more free space after executing the defined number of queue extensions. DBARS recording is temporarily disabled until queue space becomes available again. Queue space is released when queue entries are written to the DBARS Recorder table or cluster.</p> <p>Action</p> <p>Enlarge the Q2_SIZE startup parameter.</p>
DBARSM03I	<p>Recorder Queue Statistics</p> <p>Recorder queue statistics are displayed at DBARS shutdown or as a reply to the DBARS STATS command.</p>
DBARSM04I	<p>Requests queued: <i>n</i></p> <p>Total number of SQL statements stored into the recorder queue. The counter is reset at begin of day.</p>
DBARSM05I	<p>Requests processed: <i>n</i></p> <p>Total number of SQL statements retrieved from the recorder queue and written to the DBARS table. The counter is reset at begin of day.</p>
DBARSM06I	<p>Times recorder space full: <i>n</i></p> <p>Total number of times no space was found in the recorder queue. If this value is greater than zero, recorded events have been lost.</p>
DBARSM07I	<p>Pages in free queue: <i>n</i></p> <p>Number of 128 K pages currently in the free queue of the recorder space.</p>

- DBARSM08I Pages in request queue: *n*
- Number of 128 K pages currently in the "in-use" queue of the recorder space.
- DBARSM09I Max pages in request queue: *n*
- Maximum number of 128 K pages ever in the "in-use" queue of the recorder space.
- DBARSM14I Recorder Statistics
- The following messages are produced in reply to the RECSTATS command. They show statistical information about the DBARS Recorder.
- DBARSM15I Primary | Secondary Recorder currently in use
- Shows the Recorder that is currently receiving output.

DBARSM17I

Recorder cluster statistics:

The following statistics are provided when the Recorder is a VSAM cluster.

- Recorder blocks written (1)
- Recorder blocks written in session (2)
- Length of a Recorder block (3)
- Average records in Recorder block (4)
- Allocated VSAM cluster extents
- Ending VSAM cluster RBA (5)
- High-allocated VSAM cluster RBA (6)
- Available cluster space in bytes (7)
- Available cluster space percentage
- Average IO duration in milliseconds (8)
- Maximum IO duration in milliseconds

Notes

1. The total number of VSAM records (Recorder blocks) in the cluster.
2. The number of VSAM records (Recorder blocks) written during the current DBARS session.
3. The length of a VSAM record (Recorder block).
4. Individual Recorder records are blocked by DBARS before being written to the cluster as a block. The length of a Recorder record depends on the length of the recorded SQL statement.
5. The highest RBA defined for the Recorder cluster.
6. The highest RBA used for the Recorder cluster.
7. The available Recorder cluster space, in bytes and as a percentage.
8. The duration of writing the Recorder blocks to the VSAM cluster. Writing a block stores multiple Recorder records, as shown under (4).

DBARSM18I

Recorder cluster not opened yet

No records have been written yet to the Recorder.
Statistics are not available.

30.4 Messages issued by the DBARS Writer task

DBARSW00A	SQL error during CONNECT to <i>server</i> An SQLCODE was returned when DBARS connects to <i>server</i> . The SQLCA is formatted upon the console and DBARS terminates. Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support .
DBARSW01A	SQL error getting audited table list An SQLCODE was returned when DBARS obtains the list of audited tables. The SQLCA is formatted upon the console and DBARS terminates. Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support .
DBARSW02A	SQL error getting audited view list An SQLCODE was returned when DBARS obtains the list of views depending on audited tables. The SQLCA is formatted upon the console and DBARS terminates. Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.
DBARSW03A	SQL error inserting into DBARS.RECORDER An SQLCODE was returned when DBARS inserts an access row into the RECORDER table. The SQLCA is formatted upon the console. If the SQLCODE shows a recoverable error (such as lack of space) on the primary recorder, DBARS automatically switches to the auxiliary recorder table AUX_RECORDER. If the SQLCODE persists on the AUX_RECORDER as well, DBARS abends. Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.
DBARSW04I	Switching to auxiliary recorder A recoverable error has occurred on the RECORDER table and the auxiliary recorder has been activated. Action Resolve the error on the primary recorder and issue the SWITCH_REC command to activate the primary recorder again.

DBARSW05I	<p>Switched to alternate recorder</p> <p>The alternate Recorder is active.</p>
DBARSW06I	<p>Switched to primary recorder</p> <p>The primary Recorder is active.</p>
DBARSW07A	<p>SQL error deleting from DBARS.RECORDER</p> <p>A SWITCH_REC command was issued and an SQLCODE was returned when deleting rows from the primary recorder. The SQLCA is formatted upon the console and DBARS terminates.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW08A	<p>SQL error deleting from DBARS.AUX_RECORDER</p> <p>A SWITCH_REC command was issued and an SQLCODE was returned when deleting the rows from the auxiliary recorder. The SQLCA is formatted upon the console and DBARS terminates.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW09A	<p>SQL error getting audited object_ids</p> <p>An SQLCODE was returned when DBARS obtains the list of audited object ID's. The SQLCA is formatted upon the console and DBARS terminates.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW10A	<p>SQLCODE xxx selecting from DBARS_RECID</p> <p>An SQLCODE was returned when DBARS obtains the ID of the current recorder. The SQLCA is formatted upon the console and DBARS terminates.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact software support.</p>

DBARSW11A	<p>SQLCODE xxx updating DBARS_RECID</p> <p>An SQLCODE was returned when DBARS updates the ID of the current recorder. The SQLCA is formatted upon the console and DBARS terminates.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW12A	<p>VSAMRC xxxx writing to RECORDx</p> <p>A VSAM error occurred when writing to the primary (RECORDA) or the auxiliary (RECORDB) recorder.</p> <p>Action Examine the VSAM PUT returncode and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW13I	<p>VSAM Recorder cluster x opened</p> <p>The active VSAM Recorder cluster (A or B) is shown under "x".</p>
DBARSW14A	<p>Error xxxx opening Recorder y</p> <p>The Recorder (A or B) could not be opened. The decimal open error code is shown in "xxxx".</p> <p>DBARS abends.</p>
DBARSW15A	<p>VSAM error xxxx opening Recorder Index y</p> <p>The VSAM Recorder cluster (A or B) could not be opened. The decimal open error code is shown in "xxxx".</p> <p>DBARS abends.</p>
DBARSW16A	<p>VSAMRC xxxx writing to RECORDBx</p> <p>A VSAM error occurred when writing to the primary (RECORDAX) or the auxiliary (RECORDBX) recorder index.</p> <p>Action Examine the VSAM PUT returncode and perform the necessary correction. If needed, contact SPR Software Support.</p>
DBARSW17A	<p>SQL error inserting into DBARS.EXCEPTIONS</p> <p>An SQLCODE was returned when DBARS inserts a row into the EXCEPTIONS table. The SQLCA is formatted upon the console.</p> <p>Action Examine the SQLCODE and perform the necessary correction. If needed, contact SPR Software Support.</p>

DBARSW18A	<p>Starting Recorder Archive procedure xxxx</p> <p>A full condition has been detected for the current Recorder and the ARCHIVE_PROC statement was specified in the DBARS startup parameters. The user provided procedure named on the ARCHIVE_PROC statement, is now started.</p>
DBARSW19A	<p>SQLCODE xxx creating temporary tables</p> <p>A CREATE GLOBAL TEMPORARY TABLE statement failed. DBARS is terminated.</p>
DBARSW20A	<p>Syntax error in AUDIT statement</p> <p>A syntax error was detected in an AUDITNAMES table specification in the DBARS EXECPARM dataset. DBARS is terminated.</p>
DBARSW21I	<p>Tablenames recorded by DBARS:</p> <p>Output of the AUDITTAB command.</p>
DBARSW22I	<p>tablecreator.tablename</p> <p>Output of the AUDITTAB command.</p>
DBARSW23I	<p>Emptying Recorder queue before shutdown ...</p> <p>A DBARS STOP command has been submitted. Before terminating, the DBARS Writer task will write the remaining Recorder queue entries to the Recorder table or cluster.</p>
DBARSW24I	<p>Abend recovery completed.</p> <p>A program check interruption has occurred while the Write is processing a recording request.</p> <p>The Writer abend routines display diagnostic information on the console and create a formatted dump in the z/OS spool. Processing is then resumed.</p> <p>Action Forward the system log and the formatted dump to SPR software support.</p>
DBARSW25A	<p>Invalid EXCLUDE statement ignored.</p> <p>An invalid EXCLUDE statement was found following the ALLTABLES specification in the EXECPARMS dataset. The statement is ignored. Processing continues with the next statement.</p>
DBARSW26I	<p>Connecting the Initiator in Subsystem xxxx</p> <p>The DBARS Writer connects to the Initiator in the Db2 subsystem.</p>
DBARSW27I	<p>Connection to the Initiator established.</p> <p>The DBARS Writer is now connected to the Initiator.</p>

DBARSW28I Q2 space map re-ordered. RC=n

 To speed up processing, the Q2 space map has been re-ordered.
 The RC (1, 2, 3) indicates the amount of space re-ordered.

DBARSW29I End-of-extent processed by DBARS

 All extents of the current sequential Recorder were exhausted and a
 B37 z/OS abend occurred. The abend was intercepted by DBARS
 and an automatic Recorder switch is performed.

DBARSW30A RC= ERRNO= after <request_type>

 The TCP/IP error described by RC and ERRNO occurred after the
 TCP/IP call <request_type>.

Action:

 Examine the DBARS CRS startup parameter and ensure that the
 DBARSCRS server is up.

DBARSW31I Connecting to DBARSCRS ...
 IPADDRESS nnn
 PORT nnn

DBARSW32A REDUCEP control word <nnn> invalid and ignored
DBARSW33A REDUCEP data value missing after control word
DBARSW34A REDUCEP data value should not start with %

Action:

 Correct the failing record in the REDUCEP member.

30.5 Messages issued during Interactive Access Reporting

- DBARSIR01A A terminal with at least 32 lines is required
- The DBARSI program requires a terminal with 32 lines at least.
- DBARSIR02A SQLCODE *nnn* evaluating "xxx"
- When evaluating the selection expression *xxx*, SQLCODE *nnn* was returned.
- Action**
Ensure that the selection expression obeys Db2 syntax.
- DBARSIR03A PF key unassigned or function not available
- You pressed a program function key other than the ones listed in the screen footer.
- DBARSIR04A Column reformat code is invalid
- When reformatting the screen, a character other than + - < > or 2-9 was entered. You may want to display the help screen for the reformat function.
- DBARSIR05A No more than one ordering column allowed
- When reformatting the screen, more than one sort column was indicated.
- DBARSIR06A Sort error code *nnn*
- An error occurred during the sort requested from the reformat function.
- Action**
Retry the sort with a larger virtual storage. If the error persists, contact SPR Software Support.

30.6 Messages issued during Exception Reporting

- DBARSXR01A A terminal with at least 32 lines is required
- The DBARSXR program requires a terminal with 32 lines at least.
- DBARSXR02A SQLCODE *nnn* evaluating "xxx"
- When evaluating the selection expression *xxx*, SQLCODE *nnn* was returned.
- Action**
Ensure that the selection expression obeys Db2 syntax.
- DBARSXR03A PF key unassigned or function not available
- You pressed a program function key other than the ones listed in the screen footer.
- DBARSXR04A Column reformat code is invalid
- When reformatting the screen, a character other than + - < > or 2-9 was entered. You may want to display the help screen for the reformat function.
- DBARSXR05A No more than one ordering column allowed
- When reformatting the screen, more than one sort column was indicated.
- DBARSXR06A Sort error code *nnn*
- An error occurred during the sort requested from the reformat function.
- Action**
Retry the sort with a larger virtual storage. If the error persists, contact SPR Software Support.

30.7 Messages issued by the DBARS Archiving program

- DBARSA01A Missing RESTART parameter
- The Archive program detected that a previous archive run did not complete normally. In this case, the user must supply the RESTART or the NORESTART PARM argument.
- Action**
Refer to the description of the archive control parameters.
- DBARSA02A Invalid PARM argument *nnn*
- Invalid syntax on the PARM operand of the EXEC DBARSA JCL statement.
- Action**
Refer to the description of the archive control parameters.
- DBARSA03I Archiving from DBARS.RECORDER *nnn*
- Informative message that shows the SQL statement built by the DBARSA program to select the rows to be archived.
- DBARSA04I *n* rows deleted from DBARS.RECORDER
- Informative message showing the number of rows written to the archive and deleted from the Recorder table.
- DBARSA05A DBARS_RECID table cannot be accessed.
- The SEQREC archiving option was specified and an attempt was made to retrieve the current recorder cluster ID (A or B) from the DBARS_RECID table. This attempt failed.
- DBARSA06A VSAMRC x reading from RECORDA/RECORDB
- A VSAM read failure occurred when reading from the recorder cluster. The VSAM RPL feedback field is displayed under "x".
- Action**
Examine the VSAM GET returncode and perform the necessary correction. If needed, contact SPR Software Support.
- DBARSA07I Archiving cluster xxx
- The SEQREC archiving option has been specified. The message shows the name of the recorder cluster being archived as DBARS.RECORDER.A or DBARS.RECORDER.B
- DBARSA08I Submitting SWITCH_REC command to DBARS.
- The SEQREC archiving option has been specified. Before starting the archive, a request is sent to the DBARS address space for switching to the alternate recorder cluster.

30.8 Messages issued during Archive Reporting

DBARSAR01A RC *nn* opening ARCHIVE dataset

Returncode *nn* was received from z/OS when opening the ARCHIVE dataset.

Action

Review the ARCHIVE DD statement.

DBARSAR91A Parameter name too long

DBARSAR92A Parameter name invalid

DBARSAR93A Operation code invalid

DBARSAR94A Invalid alpha expression

DBARSAR95A Invalid numeric expression

DBARSAR96A Expression has no valid syntax

DBARSAR97A OUTTABLE statement incorrect

DBARSAR98A OUTLINES statement incorrect

Messages DBARSAR91A through DBARSAR98A signal a syntax error in the selection criteria supplied to the Archive Reporting program DBARSAR.

Action

Refer to eporting from an Archive for a description of the DBARSAR parameter syntax.

30.9 Messages issued during batch Reporting from the Recorder

DBARSRR01A VSAM error nn opening Recorder

VSAM error nn occurred when opening a VSAM Recorder

Action

Examine the VSAM returncode and correct it.
If the error persists, contact Software Support.

DBARSRR02A VSAMRC nn reading from RECORDER

VSAM error nn occurred when reading the VSAM Recorder

Action

Examine the VSAM returncode and correct it.
If the error persists, contact Software Support.

DBARSRR03A SQLCODE nn in module PROCESS_DB2_REC

SQLCODE nn occurred when the DBARS Recorder is on a Db2 table.

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR04A SQLCODE nn in module GET_DB2_ROW

SQLCODE nn occurred when the DBARS Recorder is on a Db2 table.

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR05A SQLCODE nn in module GET_DB2_ROW

SQLCODE nn occurred when the DBARS Recorder is on a Db2 table.

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR06A SQLCODE nn in module GET_RECID

SQLCODE nn occurred when determining the current (primary or auxiliary) Recorder

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR07A SQLCODE nn in module CHECK_PARM

SQLCODE nn occurred when processing the selection parameter CURRENT DATE

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR08A SQLCODE nn in module TABLE_INSERT

SQLCODE nn occurred when the OUTTABLE function transfers the VSAM records to the Db2 table

Action

Examine the SQLCODE and correct it.
If the error persists, contact Software Support.

DBARSRR09A Unable to acquire SQLDSECT

Insufficient storage to acquire the SQLDSECT for the DBARSRR program.

Action

Increase the REGION value on the JOB statement.
If the error persists, contact Software Support.

DBARSRR10A Redundant field xxx

The EXPORT FIELDS statement specifies more than 17 field names

Action

Correct the FIELDS statement(s).
If the error persists, contact Software Support.

DBARSRR11A Invalid name xxx on FIELDS statement

The EXPORT FIELDS statement specifies an incorrect field name.

Action

Correct the FIELDS statement.
If the error persists, contact Software Support.

DBARSRR12A Hex RC nn opening EXPORT dataset

QSAM error nn occurred when opening the export output dataset.

Action

Examine the QSAM returncode and correct it.
If the error persists, contact Software Support.

DBARSRR96A EXPORT statement incorrect

The EXPORT [NOHEADER] statement is incorrect

Action

Correct the EXPORT statement.
If the error persists, contact Software Support.

DBARSRR97A OUTTABLE statement incorrect

The OUTTABLE <name> [APPEND] statement is incorrect

Action

Correct the statement.
If the error persists, contact Software Support.

DBARSRR98A OUTLINES statement incorrect

The number of lines on the OUTLINES statement is missing or invalid.

Action

Correct the statement.
If the error persists, contact Software Support.

DBARSRR99A DBARS_JN statement incorrect

The DBARS_JN statement specifies a non-existing jobname.

Action

Correct the statement.
If the error persists, contact Software Support.

30.10 Messages issued during a Recorder FTP session

DBARSFTP00 DBARSFTP ended.

The FTP program has terminated, usually after a Modify STOP request.

DBARSFTP01 Sending <Recorder_name>

Message issued when an FTP run starts.

DBARSFTP02 <Recorder_name> sent

Message issued when an FTP run ends normally.

DBARSFTP03 nnn bytes sent at nnn KB/SEC

Statistical message issued at the normal end of an FTP run.

DBARSFTP04 FTP transfer failed

The FTP transfer was not successful. One or more DBARSFTP90 messages should precede.

DBARSFTP05 DBARS_RECID table cannot be accessed
DBARSFTP05 SQLCODE is xxx

A Db2 error occurred when DBARSFTP attempts to access the DBARS_RECID table.

DBARSFTP07 Target FTP-server is xxxxxxxxx

FTP transfer to the designated FTP server is now starting.

DBARSFTP08 Locking FTP-server xxxxxxxxx

DBARSFTP issues a cross-system z/OS enqueue for the designated FTP server and waits, if the server is in use by another DBARSFTP instance.

DBARSFTP09 FTP-server unlocked

A z/OS dequeue has been issued for the designated FTP server.

DBARSFTP80 RDJFCB failed. RC=xxx

An internal DBARSFTP error has occurred. Request software support.

DBARSFTP90 FTP OPEN failure. RC=xxx, Reason=xxx

The FTP OPEN command is invalid. Verify that the FTP server is operational.

DBARSFTP90 FTP USER failure. RC=xxx, Reason=xxx

The FTP USER command is invalid. Check the FTTPARMS library member.

DBARSFTP90 FTP PASS failure. RC=xxx, Reason=xxx

The FTP PASS command is invalid. Check the FTTPARMS library member.

DBARSFTP90 FTP xxx command failure. RC=xxx, Reason=xxx

The named FTP command is invalid. Check the FTTPARMS library member.

DBARSFTP90 API INIT failure. RC=xxx, Reason=xxx

DBARSFTP90 API GETL failure. RC=xxx

DBARSFTP90 API GETL failure. RC=xxx

The above messages indicate an internal DBARSFTP error. Contact software support.

DBARSFTP98 Invalid PARM syntax

Check the PARM keywords on the EXEC PGM=DBARSFTP statement.

DBARSFTP99 FTTPARMS open failure <RC>

The FTTPARMS library member cannot be opened. Check the DBARSFTP JCL.

30.11 Messages issued by the Centralized Recorder Server

DBARSCRS00I DBARSCRS loaded at <address>

Informative message showing the load address of the Recorder Server.

DBARSCRS01A Syntax error in above statement

A syntax error has been detected in the EXECPARM CRS statement shown.

DBARSCRS02I Recorder type: VSAM | BSAM

Informative message showing the type of the Recorder used by the Server.

DBARSCRS03I TCP/IP address space: n

Informative message showing the name of the z/OS TCPIP address space.

DBARSCRS04I TCP/IP port: nnnn

Informative message showing the port on which the Server is listening.

DBARSCRS05A DBARSCRS_QSIZE conflicts with PORT

The DBARS EXECPARM specifies both PORT and DBARSCRS_QSIZE.

DBARSCRS10A SQLCODE nnn selecting from DBARS_RECID

A Db2 error occurred when obtaining the current Recorder ID.

DBARSCRS11A SQLCODE nnn updating DBARS_RECID

A Db2 error occurred when updating the current Recorder ID.

DBARSCRS12I nn MB Communications Queue created

Informative message showing the size of the Server's queue.

DBARSCRS13I Queue address is <address>

Informative message showing the load address of the Server's queue.

DBARSCRS14A Error nnn opening Recorder A|B

Error nnn occurred when opening the BSAM Recorder.

DBARSCRS15I Waiting for incoming requests

Informative message shown when DBARSCRS has been started.

DBARSCRS16A Error nnn opening Recorder [A|B]

Error nnn occurred when opening the VSAM Recorder.

DBARSCRS17A VSAMRC nnn writing to RECORD[A|B]

Error nnn occurred when writing to the VSAM Recorder Index.

DBARSCRS18A VSAM error nnn opening Recorder Index

Error nnn occurred when writing to the VSAM Recorder Index.

DBARSCRS19A VSAMRC nnn writing to RECORD[A|B]

Error nnn occurred when writing to the VSAM Recorder.

DBARSCRS20A Starting Recorder Archive procedure nnnnnn

Recorder archiving has been started.

DBARSCRS21I Q2 space map re-ordered. RC=4

The Recorder spacemap has been optimized.

DBARSCRS28I Q2 space map re-ordered. RC=5

The Recorder spacemap has been optimized.

DBARSCRS29A Following sharing clients still active:

DBARSCRS29A <list of active DBARS instances>

DBARSCRS29A Terminate these clients and re-issue STOP

DBARSCRS cannot be stopped because the CRS clients listed all still active.
Stop all DBARS instances that are using the Centralized Recorder.

DBARSCRS30I Emptying request queue ...

A DBARSCRS stop request has been issued, but not all incoming audit records have been written to the DBARS Recorder yet.

The stop request will be honoured when all audit records have been written.

DBARSCRS31I List of connected DBARS instances

DBARSCRS32I nn connected DBARS instances found

The DBARSCRS CLIENTS command shows the DBARS instances that use the Centralized Recorder service.

DBARSCRS40I Recorder Statistics

DBARSCRS41I Primary / Secondary Recorder currently in use

DBARSCRS42A Recorder is not a VSAM cluster.

Reply messages issued by the RECSTATS command processor.

DBARSCRS90A SQLCODE nnn processing USERPARMS

An SQLCODE occurred when accessing the DBARS USERPARMS table.

DBARSCRS91A RC=nn ERRNO=nnn after <TCPIP_call>

A TCP/IP error occurred on the server side during the indicated call.
Consult the TCP/IP documentation for ERRNO.

DBARSCRS92A GETSHARED Failure RC=nn Reason=nnn

An error occurred when acquiring the DBARSCRS queue.

DBARSCRS93A SHAREMEMOBJ Failure RC=nn Reason=nnn

An error occurred when sharing the DBARSCRS queue.

DBARSCRS94A DETACH Failure RC=nn Reason=nnn

An error occurred when detaching the DBARSCRS queue.

DBARSCRS95A DETACH Failure RC=nn Reason=nnn

An error occurred when detaching the shared DBARSCRS queue.

DBARSCRS96A DYNALLOC error nnn

Allocation error nnn occurred when allocating the BSAM Recorder.

DBARSCRS99I DBARSCRS has terminated

30.12 Messages issued by the Centralized Recorder Client

DBARSIPQ00I DBARSIPQ loaded at <address>

Informative message showing the load address of the client interface.

DBARSIPQ01I DBARSCRS Queue at <address>

Informative message showing the load address of the Server's queue.

DBARSIPQ10A: IARV64 SHAREMEMOBJ Error. RC nn Reason nnn

An error occurred when attempting to share the DBARSCRS queue.

DBARSIPW01A RC=nn ERRNO=nnn after <TCPIP_call>

A TCP/IP error occurred on the client side during the indicated call.
Consult the TCP/IP documentation for ERRNO.