Oracle Rdb™

SQL Reference Manual
Volume 5

Oracle Rdb Release 7.1.4.3 for OpenVMS Alpha

December 2005

ORACLE®

SQL Reference Manual, Volume 5

Oracle Rdb Release 7.1.4.3 for OpenVMS Alpha

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Oracle SQL Reference Manual, Release 7.1.4.1

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Preface

This manual describes the syntax and semantics of the statements and language elements for the SQL (structured query language) interface to the Oracle Rdb database software.

Intended Audience

To get the most out of this manual, you should be familiar with data processing procedures, basic database management concepts and terminology, and the OpenVMS operating system.

Operating System Information

You can find information about the versions of the operating system and optional software that are compatible with this version of Oracle Rdb in the *Oracle Rdb Installation and Configuration Guide*.

For information on the compatibility of other software products with this version of Oracle Rdb, refer to the *Oracle Rdb Release Notes*.

Contact your Oracle representative if you have questions about the compatibility of other software products with this version of Oracle Rdb.

Structure

This manual is divided into five volumes. Volume 1 contains Chapter 1 through Chapter 5 and an index. Volume 2 contains Chapter 6 and an index. Volume 3 contains Chapter 7 and an index. Volume 4 contains Chapter 8 and an index. Volume 5 contains the appendixes and an index.

The index for each volume contains entries for the respective volume only and does not contain index entries from the other volumes in the set.

The following table shows the contents of the chapters and appendixes in Volumes 1, 2, 3, 4, and 5 of the *Oracle Rdb SQL Reference Manual*:

Chapter 1	Introduces SQL (structured query language) and briefly describes SQL functions. This chapter also describes conformance to the ANSI standard, how to read syntax diagrams, executable and nonexecutable statements, keywords and line terminators, and support for Multivendor Integration Architecture.
Chapter 2	Describes the language and syntax elements common to many SQL statements.
Chapter 3	Describes the syntax for the SQL module language and the SQL module processor command line.
Chapter 4	Describes the syntax of the SQL precompiler command line.
Chapter 5	Describes SQL routines.
Chapter 6 Chapter 7 Chapter 8	Describe in detail the syntax and semantics of the SQL statements. These chapters include descriptions of data definition statements, data manipulation statements, and interactive control commands.
Appendix A	Describes the different types of errors encountered in SQL and where they are documented.
Appendix B	Describes the SQL standards to which Oracle Rdb conforms.
Appendix C	Describes the SQL Communications Area, the message vector, and the SQLSTATE error handling mechanism.
Appendix D	Describes the SQL Descriptor Areas and how they are used in dynamic SQL programs.
Appendix E	Summarizes the logical names that SQL recognizes for special purposes.
Appendix F	Summarizes the obsolete SQL features of the current Oracle Rdb version.
Appendix G	Summarizes the SQL functions that have been added to the Oracle Rdb SQL interface for convergence with Oracle7 SQL. This appendix also describes the SQL syntax for performing an outer join between tables.
Appendix H	Describes information tables that can be used with Oracle Rdb.
Appendix I	Describes the Rdb system tables.
Index	Index for each volume.

Related Manuals

For more information on Oracle Rdb, see the other manuals in this documentation set, especially the following:

- *Oracle Rdb Guide to Database Design and Definition*
- *Oracle Rdb7 Guide to Database Performance and Tuning*
- *Oracle Rdb Introduction to SQL*
- *Oracle Rdb Guide to SQL Programming*

Conventions

In examples, an implied carriage return occurs at the end of each line, unless otherwise noted. You must press the Return key at the end of a line of input.

Often in examples the prompts are not shown. Generally, they are shown where it is important to depict an interactive sequence exactly; otherwise, they are omitted.

The following conventions are also used in this manual:

. . .	Vertical ellipsis points in an example mean that information not directly related to the example has been omitted.
. . .	Horizontal ellipsis points in statements or commands mean that parts of the statement or command not directly related to the example have been omitted.
e, f, t	Index entries in the printed manual may have a lowercase e, f, or t following the page number; the e, f, or t is a reference to the example, figure, or table, respectively, on that page.
boldface text	Boldface type in text indicates a new term.
< >	Angle brackets enclose user-supplied names in syntax diagrams.
[ ]	Brackets enclose optional clauses from which you can choose one or none.
$	The dollar sign represents the command language prompt. This symbol indicates that the command language interpreter is ready for input.

References to Products

The Oracle Rdb documentation set to which this manual belongs often refers to the following Oracle Corporation products by their abbreviated names:

- In this manual, Oracle Rdb refers to Oracle Rdb for OpenVMS. Version 7.1 of Oracle Rdb software is often referred to as V7.1.
- Oracle CDD/Repository software is referred to as the dictionary, the data dictionary, or the repository.
- Oracle ODBC Driver for Rdb software is referred to as the ODBC driver.
- OpenVMS means the OpenVMS Alpha operating system.

A
Error Messages

This appendix describes:

- The types and format of error messages you can encounter when using SQL
- How to find and use the documentation for error messages

A.1 Types of Error Messages and Their Format

You can receive messages not only from SQL, but also from underlying software.

Messages you encounter while using SQL come from the following levels:

- The SQL interface itself. Messages generated by SQL are preceded by a facility code of SQL. For example:

  ```
  %SQL-E-CURALROPE, Cursor K was already open
  ```

  In programs, you can use the message vector structure in the SQL_ SIGNAL, SQL_GET_ERROR_TEXT, SQL_GET_MESSAGE_VECTOR, and SQL$GET_ERROR_TEXT routines, described in Section C.2, to signal errors and return the corresponding message text.

- Common Operating System Interface (COSI) facility error messages. For example:

  ```
  %COSI-F-NOQUAL, qualifiers not allowed - supply only verb and parameters
  ```

- The underlying database product. The facility code for messages generated by the underlying database depends on the database product with which you are using SQL.

  Oracle Rdb messages are preceded by a facility code of RDMS. For example:

  ```
  %RDMS-F-INVDB_NAME, invalid database name
  ```

  Refer to the appropriate documentation for other products.

- The repository. Messages generated by the repository are preceded by a facility code of CDD. For example:

  ```
  %CDD-E-ERRSHOW, error displaying object
  ```

Whatever the source of an error message, the format is the same. All error messages contain the following elements:

- The facility name preceded by a percent sign (%) or a hyphen (-)
- The severity code followed by a hyphen (-)

  Table A–1 lists the severity codes in order of increasing severity.
- The diagnostic error message name followed by a comma (,)

  This name identifies the message. In the documentation for error messages, the messages are alphabetized within each facility by diagnostic error message name.
- The diagnostic error message text

  The text is a brief description of the problem. Error messages may contain string substitutions that are specific to a user's error. In the documentation for error messages, these string substitutions are delimited by angle brackets (< >) within a message. For example:

  ```
  %SQL-F-CURNOTOPE, Cursor <str> is not opened
  ```

  If you receive this message, SQL substitutes the actual string (in this case, a cursor name) for <str>.

You can suppress the display of any or all elements of an error message with the SET MESSAGE command in DCL.

Table A–1 Explanation of Error Message Severity Codes

Code	Severity	Explanation
S	Success	Indicates that your command executed successfully.
I	Information	Reports on actions taken by the software.

(continued on next page)

Table A–1 (Cont.) Explanation of Error Message Severity Codes

Code	Severity	Explanation
W	Warning	Indicates error conditions for which you may not need to take corrective action.
E	Error	Indicates conditions that are not fatal, but that must be handled or corrected.
F	Fatal	Indicates conditions that are fatal and must be handled or corrected.

A.2 Error Message Documentation

Because error messages are updated frequently, documentation is provided in the following text files:

- SQL messages:

  In SYS$HELP:SQL$MSGnn.DOC

  where *nn* is the current version number for Oracle Rdb.

  This file contains the same text as the Help Errors help topic in interactive SQL.

- RDB messages:

  In SYS$HELP:RDB_MSGnn.DOC

  where *nn* is the current version number for Oracle Rdb.

- RDMS messages:

  In SYS$HELP:RDMS_MSG.DOC

- COSI messages:

  In SYS$HELP:COSI_MSG.DOC

- SQL/Services messages:

  In SYS$HELP:SQLSRV$MSG.DOC

- Repository messages:

  In SYS$HELP:CDD_MSG.DOC

The message documentation for all the facilities follows the same format, with messages alphabetized by message name. After the message name and text, the documentation includes an explanation and suggested user action.

The online message documentation files may be updated even if you do not install a new version of SQL. In particular, any installation of Oracle Rdb databases may replace the RDB_MSG.DOC file with one that is more up-to-date.

You can print the online message documentation files for reference. In addition, you can search the files for the message information you need.

A.3 Errors Generated When You Use SQL Statements

When you write application programs that use SQL, you must use one of the following methods to return the error messages:

- The SQLCODE parameter, which stores a value that represents the execution status of SQL statements.
- The SQLSTATE status parameter, a string of five characters, provides error handling that complies with the ANSI/ISO SQL standard. See Appendix C for more information on the SQLSTATE status parameter.
- The longword array RDB$MESSAGE_VECTOR, which stores information about the execution status of SQL statements.
- The calls sql_signal, sql_get_error_text, and SQL$GET_ERROR_TEXT, which use error information returned through the RDB$MESSAGE_ VECTOR array.
- The call sql_get_message_vector, which retrieves information from the message vector about the status of the last SQL statement.
- The SQL statement WHENEVER, which provides error handling for all SQL statements that follow the WHENEVER statement. (However, you cannot use this statement in programs that call procedures in an SQL module.)

For more information about handling errors using SQL options, see the *Oracle Rdb Guide to SQL Programming*.

Table A–2 lists SQL statements and errors they commonly generate at run time. This is not an exhaustive list. The second column lists the error message status code and the third column lists the corresponding value of the SQLCODE field in the SQLCA. See Appendix C for more information about SQLCODE values.

Table A–2 SQL Errors Generated at Run Time

SQL Statement	Error Status Code[2]	SQLCODE Value
ALTER DOMAIN	SQL$_BAD_LENGTH	–1029
	SQL$_BAD_SCALE	–1030
	SQL$_NO_SUCH_FIELD	–1027
ALTER TABLE	RDB$_DEADLOCK	–913
	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
	RDB$_NO_PRIV	–1028
	RDB$_READ_ONLY_REL	–1031
	RDB$_READ_ONLY_TRANS	–817
	RDB$_READ_ONLY_VIEW	–1031
	RDB$_REQ_NO_TRANS	Not available[1]
	SQL$_BAD_LENGTH	–1029
	SQL$_BAD_SCALE	–1030
	SQL$_COLEXISTS	–1023
	SQL$_FLDNOTDEF	–1024
	SQL$_FLDNOTINREL	–1024
	SQL$_NO_SUCH_FIELD	–1027
ATTACH	RDB$_REQ_WRONG_DB	–1020
CLOSE	SQL$_CURNOTOPE	–501
COMMIT	RDB$_DEADLOCK	–913
	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
	SQL$_NO_TXNOUT	–1005
CREATE DOMAIN	SQL$_FIELD_EXISTS	–1026
CREATE VIEW	RDB$_DEADLOCK	–913
	RDB$_LOCK_CONFLICT	–1003
	SQL$_NO_SUCH_FIELD	–1027

[1]No specific numeric value. Check the SQLCODE for negative values.

[2]-1 is a general error SQLCODE value that does not correspond to any specific error. Use sql_signal or sql_get_error_text to return a meaningful error.

(continued on next page)

Table A–2 (Cont.) SQL Errors Generated at Run Time

SQL Statement	Error Status Code[2]	SQLCODE Value
	SQL$_REL_EXISTS	–1025
DELETE	RDB$_DEADLOCK	–913
	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
DELETE . . . WHERE	RDB$_DEADLOCK	–913
CURRENT OF . . .	RDB$_INTEG_FAIL	–1001
	SQL$_CURNOTOPE	–501
	SQL$_FETNOTDON	–508
FETCH	RDB$_DEADLOCK	–913
	RDB$_LOCK_CONFLICT	–1003
	RDB$_STREAM_EOF	100
	SQL$_CURNOTOPE	–501
	SQL$_NULLNOIND	–305
INSERT	RDB$_ARITH_EXCEPT	–304
	RDB$_DEADLOCK	–913
	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
	RDB$_NO_DUP	–803
	RDB$_NO_PRIV	–1028
	RDB$_NOT_VALID	–1002
	RDB$_OBSOLETE_METADATA	–1032
	RDB$_READ_ONLY_REL	–1031
	RDB$_READ_ONLY_TRANS	–817
	RDB$_READ_ONLY_VIEW	–1031
	RDB$_REQ_NO_TRANS	Not available[1]
	RDB$_REQ_WRONG_DB	–1020
	RDB$_UNRES_REL	–1033

[1]No specific numeric value. Check the SQLCODE for negative values.

[2]-1 is a general error SQLCODE value that does not correspond to any specific error. Use sql_signal or sql_get_error_text to return a meaningful error.

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Table A–2 (Cont.) SQL Errors Generated at Run Time

SQL Statement	Error Status Code[2]	SQLCODE Value
OPEN	RDB$_DEADLOCK	–913
	RDB$_LOCK_CONFLICT	–1003
ROLLBACK	SQL$_NO_TXNOUT	–1005
SET TRANSACTION	RDB$_DEADLOCK	–913
	RDB$_LOCK_CONFLICT	–1003
	SQL$_BAD_TXN_STATE	–1004
singleton SELECT	RDB$_DEADLOCK	–913
	RDB$_LOCK_CONFLICT	–1003
	SQL$_NULLNOIND	–305
	SQL$_SELMORVAL	–811
UPDATE	RDB$_DEADLOCK	–913
	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
	RDB$_NO_DUP	–803
	RDB$_NOT_VALID	–1002
	RDB$_READ_ONLY_REL	–1031
UPDATE . . . WHERE	RDB$_DEADLOCK	–913
CURRENT OF . . .	RDB$_INTEG_FAIL	–1001
	RDB$_LOCK_CONFLICT	–1003
	RDB$_NO_DUP	–803
	RDB$_NOT_VALID	–1002
	SQL$_CURNOTOPE	–501
	SQL$_FETNOTDON	–508

[2] -1 is a general error SQLCODE value that does not correspond to any specific error. Use sql_signal or sql_get_error_text to return a meaningful error.

A.4 Identifying Precompiler and Module Language Errors

The SQL precompiler and the SQL module language processor let you identify (flag) syntax that is not ANSI/ISO SQL standard. See Chapter 3 and Chapter 4 for more information.

Error messages for SQL precompilers and SQL module language are flagged in the following way:

```
EXEC SQL SELECT SUM(DISTINCT QTY), AVG(DISTINCT QTY)    /* multiple distincts*/
%SQL-I-NONSTADIS, (1) The standard only permits one DISTINCT in a select expression
    INTO :int1, :int2 FROM D.SP;            /*    in a query     */
```

B

SQL Standards

This appendix describes the SQL standards to which Oracle Rdb conforms.

B.1 ANSI/ISO/IEC SQL 1999 Standard

- The SQL interface to Oracle Rdb is referred to as SQL. This interface is the Oracle Rdb implementation of the SQL standard commonly referred to as the ANSI/ISO SQL standard or SQL99.
- The new SQL standard adopted in 1999 consists of the following five parts:
  - ANSI/ISO/IEC 9075-1:1999, Information technology - Database language - SQL - Part 1: Framework (SQL/Framework)
  - ANSI/ISO/IEC 9075-2:1999, Information technology - Database language - SQL - Part 2: Foundation (SQL/Foundation)
  - ANSI/ISO/IEC 9075-3:1999, Information technology - Database language - SQL - Part 3: Call-Level Interface (SQL/CLI)
  - ANSI/ISO/IEC 9075-4:1999, Information technology - Database language - SQL - Part 4: Persistent Stored Modules (SQL/PSM)
  - ANSI/ISO/IEC 9075-5:1999, Information technology - Database language - SQL - Part 5: Host Language Bindings (SQL/Bindings)

  In general, the Oracle Rdb release 7.1 documentation refers to this standard as SQL:1999. SQL:1999 supersedes the SQL92 standard.

  The minimal conformance level for SQL:1999 is known as Core. Core SQL:1999 is a superset of the SQL92 Entry Level specification. Oracle Rdb is broadly compatible with the SQL:1999 Core specification. However, a small number of SQL:1999 Core features are not currently implemented in Oracle Rdb or differ from the Oracle Rdb implementation. Oracle Corporation is committed to fully supporting SQL:1999 Core functionality in a future release, while providing upward compatibility for existing applications.

Additionally, Oracle Rdb also complies to most of the ANSI/ISO/IEC 9075-4:1999 (Persistent Stored Modules) portion of the standard.

The following functionality described by SQL:1999 CORE is not currently available in Oracle Rdb:

- SQL99 flagger

  The flagger would alert the programmer to extensions to the SQL:1999 SQL database language.

- Basic Information Schema, and Documentation Schema

  A set of tables and views that describe the database definitions, similar in content to the Rdb system tables.

- TIME and TIMESTAMP precision up to 6 fractional seconds

  Oracle Rdb currently supports a maximum fractional second precision of 2.

- CREATE TYPE

  The CREATE TYPE statement in the SQL:1999 CORE allows a user to define a typed name, similar to a domain, but with strong typing rules.

- REVOKE . . . { RESTRICT | CASCADE }

  These variations to REVOKE requires that a check be performed during protection updates so that privilege changes do not effect the correct execution of existing procedures and functions.

You can obtain a copy of ANSI standards from the following address:

American National Standards Institute
11 West 42nd Street
New York, NY 10036
USA
Telephone: 212.642.4900
FAX: 212.398.0023

Or from their web site:

http://webstore.ansi.org/ansidocstore/default.asp

A subset of ANSI standards, including the SQL standard, are X3 or NCITS standards. You can obtain these from the National Committee for Information Technology Standards (NCITS) at:

http://www.cssinfo.com/ncitsquate.html

The Core SQL:1999 features that Oracle Rdb fully supports are listed in Table B–1.

Table B–1 Fully Supported Core SQL:1999 Features

Feature ID	Feature
E011	Numeric data types
E021	Character data types
E031	Identifiers
E051	Basic query specification
E061	Basic predicates and search conditions
E071	Basic query expressions
E081	Basic privileges
E091	Set functions
E101	Basic data manipulation
E111	Single row SELECT statement
E121	Basic cursor support
E131	Null value support (nulls in lieu of values)
E141	Basic integrity constraints
E151	Basic transaction support
E152	Basic SET TRANSACTION statement
E153	Updatable queries with subqueries
E161	SQL comments using leading double minus
E171	SQLSTATE support
E182	Module language
F041	Basic joined table
F081	UNION and EXCEPT in views
F131	Grouped operations
F181	Multiple module support
F201	CAST function
F221	Explicit defaults
F261	CASE expression

(continued on next page)

Table B–1 (Cont.) Fully Supported Core SQL:1999 Features

Feature ID	Feature
F311	Schema definition statement
F471	Scalar subquery values
F481	Expanded NULL predicate

Core SQL:1999 features that Oracle Rdb partially supports are listed in Table B–2.

Table B–2 Partially Supported Core SQL:1999 Features

Feature ID	Feature	Partial Support
F031	Basic schema	Oracle Rdb fully supports the following manipulation subfeatures: • F031-01, Clause 11, "Schema definition and manipulation": Selected facilities as indicated by the subfeatures of this Feature • F031-02, CREATE VIEW statement • F031-03, GRANT statement • F031-04, ALTER TABLE statement: ADD COLUMN clause • F031-13, DROP TABLE statement: RESTRICT clause • F031-16, DROP VIEW statement: RESTRICT clause Oracle Rdb does not support the following subfeature: • F031-19, REVOKE statement: RESTRICT clause

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Table B–2 (Cont.) Partially Supported Core SQL:1999 Features

Feature ID	Feature	Partial Support
F051	Basic date and time	Oracle Rdb fully supports the following subfeatures: • F051-01, DATE data type (including support of DATE literal) • F051-02, TIME data type (including support of TIME literal) with fractional seconds precision of at least 0. • F051-03, TIMESTAMP data type (including support of TIMESTAMP literal) with the maximum fractional seconds precision of 2 • F051-04, comparison predicate on DATE, TIME, and TIMESTAMP data types • F051-05, explicit CAST between datetime types and character types • F051-06, CURRENT_DATE • F051-07, LOCALTIME • F051-08, LOCALTIMESTAMP Oracle Rdb does not support the following subfeature: • F051-03, fractional seconds precision greater than 2

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Table B–2 (Cont.) Partially Supported Core SQL:1999 Features

Feature ID	Feature	Partial Support
T321	Basic SQL-invoked routines	Oracle Rdb fully supports the following subfeatures: • T321-01, user-defined functions with no overloading • T321-02, user-defined stored procedures with no overloading • T321-03, function invocation • T321-04, CALL statement • T321-05, RETURN statement Oracle Rdb does not support the following subfeatures: • T321-06, ROUTINES view • T321-07, PARAMETERS view

The Core SQL:1999 features that Oracle Rdb does not support are listed in Table B–3.

Table B–3 Unsupported Core SQL:1999 Features

Feature ID	Feature
F021	Basic information schema; you can get this information from the Oracle Rdb system tables
F501	Features and conformance views
F812	Basic flagging; Oracle Rdb's SQL flagger only shows up through SQL92
S011	Distinct data types

B.2 SQL:1999 Features in Rdb

Oracle Rdb release 7.1 adds the following SQL:1999 features to SQL:

- AND CHAIN clause for COMMIT and ROLLBACK
- LOCALTIME, LOCALTIMESTAMP, ABS functions
- START TRANSACTION statement
- ITERATE loop control statement

- WHILE looping statement using revised SQL:1999 syntax
- REPEAT looping statement
- Searched CASE statement
- DETERMINISTIC, and NOT DETERMINISTIC attributes

  These clauses replace NOT VARIANT and VARIANT attributes, respectively.
- RETURNS NULL ON NULL INPUT and CALLED ON NULL INPUT clauses for functions
- Support for module global variables which can be accessed by all routines in a module.
- DEFAULT VALUES clause for INSERT
- DEFAULT keyword for INSERT and UPDATE
- Full SIGNAL statement syntax
- BETWEEN SYMMETRIC predicate support
- USER and ROLE support including the GRANT/REVOKE enhancements
- INITIALLY IMMEDIATE and INITIALLY DEFERRED clauses for constraints
- UNIQUE predicate
- TABLE query specification

  This is a shorthand for SELECT * FROM
- DISTINCT keyword for UNION
- FOREIGN KEY reference semantics

  The columns listed by the REFERENCES clause can be in a different order to that of the matching PRIMARY KEY or UNIQUE constraint. Requires SQL99 dialect.
- ALTER MODULE, ALTER PROCEDURE and ALTER FUNCTION statements
- EXCEPT DISTINCT operator
- INTERSECT DISTINCT operator
- CORRESPONDING clause for UNION, EXCEPT and INTERSECT operators

- VAR_POP, VAR_SAMP, STDDEV_POP, STDDEV_SAMP statistical operators
- FILTER modifier for statistical functions

B.3 Establishing SQL:1999 Semantics

The following commands can be used to establish the SQL:1999 database language standard semantics:

- SET DIALECT
- SET QUOTING RULES
- SET KEYWORD RULES
- SET DEFAULT DATE FORMAT

For example:

```
SQL> SET DIALECT 'SQL99';
```

In most cases, the semantics of the SQL99 dialect are the same as SQL92. As new features are added, these may have different semantics in these two dialects.

The following command displays the current settings for this connection:

```
SQL> SHOW CONNECTION <connectionname>
```

For example:

```
SQL> show connection rdb$default_connection
Connection: RDB$DEFAULT_CONNECTION
Default alias is RDB$DBHANDLE
Default catalog name is RDB$CATALOG
Default schema name is SMITHI
Dialect: SQL99
Default character unit: CHARACTERS
Keyword Rules: SQL99
View Rules: ANSI/ISO
Default DATE type: DATE ANSI
Quoting Rules: ANSI/ISO
Optimization Level: DEFAULT
Hold Cursors default: WITH HOLD PRESERVE NONE
Quiet commit mode: ON
Compound transactions mode: EXTERNAL
Default character set is DEC_MCS
National character set is DEC_MCS
Identifier character set is DEC_MCS
Literal character set is DEC_MCS
Display character set is UNSPECIFIED
```

The session variables DIALECT, DATE_FORMAT, QUOTING_RULES, and KEYWORD_RULES can also return the string 'SQL99'.

For example:

```
SQL> declare :a, :b, :c, :d char(10);
SQL> get environment (session)
cont>     :a = DIALECT,
cont>     :b = DATE_FORMAT,
cont>     :c = QUOTING_RULES,
cont>     :d = KEYWORD_RULES;
SQL> print :a, :b, :c, :d;
 A           B           C           D
 SQL99       SQL99       SQL99       SQL99
```

C

The SQL Communications Area (SQLCA) and the Message Vector

The SQLCA and message vector are two separate host structures that SQL declares when it precompiles an INCLUDE SQLCA statement.

Both the SQLCA and the message vector provide ways of handling errors:

- The SQLCA is a collection of parameters that SQL uses to provide information about the execution of SQL statements to application programs. The SQLCODE parameter in the SQLCA shows if a statement was successful and, for some errors, the particular error when a statement is not successful.

  To illustrate how the SQLCA works in applications, interactive SQL displays its contents when you issue the SHOW SQLCA statement.

- The message vector is also a collection of parameters that SQL updates after it executes a statement. It lets programs check if a statement was successful, but provides more detail than the SQLCA about the type of error if a statement is not successful. The message vector, for example, provides a way to access any follow-on messages in addition to those containing the facility code RDB or SQL.

  You can use the following steps to examine the message vector:

  - Assign any value to the logical name SQL$KEEP_PREP_FILES.
  - Precompile any program that contains the line "EXEC SQL INCLUDE SQLCA". (You can use the programs in the sample directory.)
  - Examine the generated host language program.

SQL updates the contents of the SQLCA and the message vector after completion of every executable SQL statement (nonexecutable statements are the DECLARE, WHENEVER, and INCLUDE statements).

You do not have to use the INCLUDE SQLCA statement in programs. However, if you do not, you must explicitly declare the SQLCODE parameter to receive values from SQL. SQLCODE is explicitly declared as an unscaled, signed longword integer.

SQLCODE is a deprecated feature of the ANSI/ISO SQL standard and is replaced by SQLSTATE. To comply with the ANSI/ISO SQL standard, you should explicitly declare either SQLCODE or, preferably, SQLSTATE instead of using the INCLUDE SQLCA statement. SQLCA (and the INCLUDE SQLCA statement) is not part of the ANSI/ISO SQL standard. If you declare SQLCODE or SQLSTATE but use the INCLUDE SQLCA statement, SQL uses the SQLCA.

Programs that do not use the INCLUDE SQLCA statement will not have the message vector declared by the precompiler. Such programs must explicitly declare the message vector if they:

- Use the RDB$LU_STATUS field of the message vector in their error checking
- Use system calls such as SYS$PUTMSG

The message vector is not part of the ANSI/ISO SQL standard.

When the SQLCA structure is explicitly declared by a program, SQL does not update the SQLERRD fields. If you want the SQLERRD fields updated, include the SQLCA definitions in the program using the EXEC SQL INCLUDE SQLCA statement.

Section C.1 and Section C.2 describe the SQLCA and the message vector in more detail. Section C.3 shows the declarations SQL makes for them in different host language programs.

C.1 The SQLCA

The only fields of interest in the SQLCA are the SQLCODE field and the second through sixth elements of the SQLERRD array.

Example C–1 shows the interactive SQL display for the SQLCA after the "attempt to fetch past end of stream" error.

Example C–1 Fields in the SQLCA

```
SQL> SHOW SQLCA
SQLCA:
        SQLCAID:        SQLCA           SQLCABC:        128
        SQLCODE:        100
        SQLERRD:        [0]: 0
                        [1]: 0
                        [2]: 0
                        [3]: 0
                        [4]: 0
                        [5]: 0
        SQLWARN0:       0       SQLWARN1:       0       SQLWARN2:       0
        SQLWARN3:       0       SQLWARN4:       0       SQLWARN5:       0
        SQLWARN6:       0       SQLWARN7:       0
        SQLSTATE:       02000
```

SQLSTATE is not part of the SQLCA, although it appears in the display.

The remainder of this section describes the fields of the SQLCA.

Fields of the SQLCA

SQLCAID

An 8-character field whose value is always the character string SQLCA. It is provided for compatibility with DB2 databases. The FORTRAN SQLCA does not include this field.

SQLCABC

An integer field whose value is always the length, in bytes, of the SQLCA. It is provided for compatibility with DB2 databases. The value is always 128. The FORTRAN SQLCA does not include this field.

SQLCODE

An integer field whose value indicates the error status returned by the most recently executed SQL statement. A positive value other than 100 indicates a warning, a negative value indicates an error, and a zero indicates successful execution.

Table C–1 shows the possible numeric and literal values that SQL returns to the SQLCODE field and explains the meaning of the values.

Table C–1 Values Returned to the SQLCODE Field

Numeric Value	Literal Value	Meaning
Success Status Code		
0	SQLCODE_SUCCESS	Statement completed successfully.
Warning Status Codes		
100	SQLCODE_EOS	SELECT statement or cursor came to the end of stream.
1003	SQLCODE_ELIM_NULL[1]	Null value was eliminated in a set function.
1004	SQLCODE_TRUN_RTRV[1]	String truncated during assignment. This occurs only during data retrieval.
Error Status Codes		
–1	SQLCODE_RDBERR	Oracle Rdb returned an error. The value of –1 is a general error SQLCODE value returned by any error not corresponding to the other values in this table. Use sql_signal or sql_get_error_text to return a meaningful error.
–304	SQLCODE_OUTOFRAN	Value is out of range for a host variable.
–305	SQLCODE_NULLNOIND	Tried to store a null value into a host language variable with no indicator variable.
–306	SQLCODE_STR_DAT_ TRUNC[1]	String data, right truncation.
–307	SQLCODE_INV_DATETIME	Date-time format is invalid.
–501	SQLCODE_CURNOTOPE	Cursor is not open.
–502	SQLCODE_CURALROPE	Cursor is already open.
–507	SQLCODE_UDCURNOPE	Cursor in an UPDATE or DELETE operation is not opened.
–508	SQLCODE_UDCURNPOS	Cursor in an UPDATE or DELETE operation is not positioned on a row.
–509	SQLCODE_UDCURDEL	Cursor in an UPDATE or DELETE operation is positioned on a deleted row.

[1]Only the SQL92 and SQL99 dialects return this value.

(continued on next page)

Table C–1 (Cont.) Values Returned to the SQLCODE Field

Numeric Value	Literal Value	Meaning
Error Status Codes		
–803	SQLCODE_NO_DUP	Updating would cause duplication on a unique index.
–811	SQLCODE_SELMORVAL	The result of a singleton select returned more than one value.
–817	SQLCODE_ROTXN	Attempt to update from a read-only transaction.
–913	SQLCODE_DEADLOCK	Request failed due to resource deadlock.
–1001	SQLCODE_INTEG_FAIL	Constraint failed.
–1002	SQLCODE_NOT_VALID	Valid-if failed.
–1003	SQLCODE_LOCK_ CONFLICT	NO WAIT request failed because resource was locked.
–1004	SQLCODE_BAD_TXN_ STATE	Invalid transaction state–the transaction already started.
–1005	SQLCODE_NO_TXN	No transaction active.
–1006	SQLCODE_BAD_VERSION	Version of the underlying system does not support a feature that this query uses.
–1007	SQLCODE_TRIG_ERROR	Trigger forced an error.
–1008	SQLCODE_NOIMPTXN	No implicit distributed transaction outstanding.
–1009	SQLCODE_DISTIDERR	Distributed transaction ID error.
–1010	SQLCODE_BAD_CTX_VER	Version field in the context structure is defined incorrectly.
–1011	SQLCODE_BAD_CTX_ TYPE	Type field in the context structure is defined incorrectly.
–1012	SQLCODE_BAD_CTX_LEN	Length field in the context structure is defined incorrectly.
–1013	SQLCODE_BASROWDEL	Row that contains the list has been deleted.
–1014	SQLCODE_DIFFDEFINV	Invoker of the module is not the same as the definer (the user who compiled the module).
–1015	SQLCODE_STMTNOTPRE	Dynamic statement is not prepared.
–1016	SQLCODE_NOSUCHCONN	Connection does not exist.

(continued on next page)

Table C–1 (Cont.) Values Returned to the SQLCODE Field

Numeric Value	Literal Value	Meaning
Error Status Codes		
–1017	SQLCODE_CONNAMEXI	Connection name already exists.
–1018	SQLCODE_DBENVSYNERR	Database environment specification contains a syntax error.
–1019	SQLCODE_DBSPECSYNERR	Database specification contains a syntax error.
–1020	SQLCODE_ATTACHERR	Error attaching to the database.
–1021	SQLCODE_NOSUCHALIAS	Alias is not known.
–1022	SQLCODE_ALIASINUSE	Alias is already declared.
–1023	SQLCODE_COLEXISTS	Column already exists in the table.
–1024	SQLCODE_COLNOTDEF	Column not defined in the table.
–1025	SQLCODE_TBLEXISTS	Table already exists in the database or schema.
–1026	SQLCODE_DOMEXISTS	Domain already exists in the database or schema.
–1027	SQLCODE_DOMNOTDEF	Domain is not defined in the database or schema.
–1028	SQLCODE_NO_PRIV	No privilege for attempted operation.
–1029	SQLCODE_BAD_LENGTH	Negative length specified for a column.
–1030	SQLCODE_BAD_SCALE	Negative scale specified for a column.
–1031	SQLCODE_RO_TABLE	Attempt to update a read-only table.
–1032	SQLCODE_OBSMETADATA	Metadata no longer exists.
–1033	SQLCODE_UNRES_REL	Table is not reserved in the transaction.
–1034	SQLCODE_CASENOTFND	Case not found; WHEN not specified.
–1035	SQLCODE_CHKOPT_VIOL	Integer failure with check option.
–1036	SQLCODE_UNTERM_C_STR	Unterminated C string.
–1037	SQLCODE_INDIC_OVFLOW	Indicator overflow.
–1038	SQLCODE_INV_PARAM_VAL	Invalid parameter value.

(continued on next page)

Table C–1 (Cont.) Values Returned to the SQLCODE Field

Numeric Value	Literal Value	Meaning
Error Status Codes		
–1039	SQLCODE_NULL_ELIMIN	Null eliminated in the set function.
–1040	SQLCODE_INV_ESC_SEQ	Invalid escape sequence.
–1041	SQLCODE_RELNOTDEF	Table not defined in the database or schema.

Programs can use the literal values to check for success, the end of record stream warnings, or specific errors. Your program can check for particular error codes and execute different sets of error-handling statements depending upon the error code returned. However, because the values in Table C–1 do not reflect all the possible errors or warnings, your program should check for *any* negative value.

SQL inserts the RDB message vector (see Section C.2) along with the SQLCA structure when it executes an SQL statement.

Also, string truncation conditions are only reported when the dialect is set to SQL92 or SQL99 prior to a database attach in interactive SQL or when your application is compiled. For example:

```
SQL> SET DIALECT 'SQL99';
SQL> ATTACH 'FILENAME mf_personnel';
SQL> DECLARE :ln CHAR(10);
SQL> SELECT last_name INTO :ln FROM employees WHERE employee_id = '00164';
%RDB-I-TRUN_RTRV, string truncated during assignment to a variable or parameter
SQL> SHOW SQLCA
SQLCA:
        SQLCAID:        SQLCA           SQLCABC:        128
        SQLCODE:        1004
        SQLERRD:        [0]: 0
                        [1]: 0
                        [2]: 1
                        [3]: 0
                        [4]: 0
                        [5]: 0
        SQLWARN0:       0       SQLWARN1:       0       SQLWARN2:       0
        SQLWARN3:       0       SQLWARN4:       0       SQLWARN5:       0
        SQLWARN6:       0       SQLWARN7:       0
        SQLSTATE:       01004
%RDB-I-TRUN_RTRV, string truncated during assignment to a variable or parameter
```

For each language, SQL provides a file that contains the declarations of all the error literals shown in Table C–1. You can include this file in precompiled SQL and module language programs.

Table C–2 shows how to include this file in your program.

Table C–2 Including the Error Literals File in Programs

Precompiled or Module Language	Declaration
Ada	with SQL_SQLCODE; with SQL_SQLDA; with SQL_SQLDA2; [1]
BASIC	%INCLUDE "sys$library:sql_literals.bas"
C	#include "sys$library:sql_literals.h"
COBOL	COPY 'SYS$LIBRARY:SQL_LITERALS'
FORTRAN	INCLUDE 'SYS$LIBRARY:SQL_LITERALS.FOR'
Pascal	%include 'sys$library:sql_literals.pas'
PL/I	%INCLUDE 'sys$library:sql_literals.pli';

[1]You must compile the Ada package, SYS$LIBRARY:SQL_LITERALS.ADA, before you use it in a program. Only declare SQL_SQLDA and SQL_SQLDA2 when you use dynamic SQL.

In addition to the error literals, the file contains declarations for the SQLTYPE field in the SQLDA. See Appendix D for information about the SQLTYPE field.

Example C–2 shows how to include the error literals file in a COBOL program.

Example C–2 Including Error Literals in a COBOL Program

```
IDENTIFICATION DIVISION.
PROGRAM-ID. LITERAL-TESTS.
*
* This program tests the use of symbolic literals for SQLCODE and
* SQLDA_DATATYPE.  All the literal definitions are part of a file that
* is used with the COPY command.
*
DATA DIVISION.
WORKING-STORAGE SECTION.
COPY SQL_LITERALS.
EXEC SQL INCLUDE SQLCA END-EXEC.
01 CDE          PIC X(5).
01 DISP_SQLCODE PIC S9(9) DISPLAY SIGN LEADING SEPARATE.
01 GETERRVARS.
           02  error-buffer-len         PIC S9(9) COMP VALUE 132.
           02  error-msg-len            PIC S9(9) COMP.
           02  error-buffer             PIC X(132).

exec sql whenever sqlerror continue end-exec.

PROCEDURE DIVISION.

*
* test for sqlcode -501 SQLCODE_CURNOTOPE
*
        exec sql declare A cursor for
                select college_code from colleges
                where college_name like 'D%' order by 1
        end-exec.
        exec sql fetch A into :CDE end-exec.
        if sqlcode = SQLCODE_CURNOTOPE
        then
            MOVE sqlcode to DISP_SQLCODE
            DISPLAY "SQLCODE after attempt to fetch is ", DISP_SQLCODE
        CALL "sql_get_error_text" USING BY REFERENCE error-buffer,
                                        BY VALUE error-buffer-len,
                                        BY REFERENCE error-msg-len.
            DISPLAY BUFFER(1:error-msg-len)
        end-if.
        exec sql close A end-exec.
*
```

(continued on next page)

Example C–2 (Cont.) Including Error Literals in a COBOL Program

```
* test for SQLCODE 0 SQLCODE_SUCCESS
*
        exec sql
        insert into employees (employee_id, last_name, sex)
            values ('00999','Jones','M')
        end-exec.
        if sqlcode = SQLCODE_SUCCESS
        then
            MOVE sqlcode to DISP_SQLCODE
            DISPLAY "SQLCODE after insert is ", DISP_SQLCODE
        CALL "sql_get_error_text" USING BY REFERENCE error-buffer,
                                        BY VALUE error-buffer-len,
                                        BY REFERENCE error-msg-len.
            DISPLAY BUFFER(1:error-msg-len)
        end-if.

        EXEC SQL ROLLBACK END-EXEC.
        STOP RUN.
```

SQLERRM

The SQLERRM is a structure containing two fields: a word field called SQLERRML and a 70-character field called SQLERRMC. It is provided only for compatibility with DB2 software.

SQLERRD[x]

A zero-based array of six integers. The only elements of the array that SQL uses are the second through sixth elements (SQLERRD[1], SQLERRD[2], SQLERRD[3], SQLERRD[4] and SQLERRD[5] in the display from SHOW SQLCA).

When you use dynamic SQL, SQL puts a value in the second element (SQLERRD[1]) after SQL executes the DESCRIBE statement. The values represent the following:

- 0: The statement is any SQL statement except a SELECT statement or CALL statement.
- 1: The statement is a SELECT statement.
- 2: The statement is a CALL statement.

SQL puts a value in the third element (SQLERRD[2]) after successful execution of the following statements:

- INSERT: The number of rows stored by the statement.
- UPDATE: The number of rows modified by the statement.

- DELETE: The number of rows deleted by the statement.
- FETCH: The number of the row on which the cursor is currently positioned.
- SELECT: The number of rows in the result table formed by the SELECT statement. (Note: The SQLERRD[2] field is not updated for dynamic SELECT statements.)

SQL puts the following values in the third and fourth elements after successful execution of an OPEN statement for a table cursor:

- SQLERRD[2]: Estimated result table cardinality
- SQLERRD[3]: Estimated I/O operations

You must recompile application modules so that the new values in SQLERRD[2] and SQLERRD[3] can be returned.

SQL puts the following values in the second, fourth, fifth, and sixth elements after successful execution of an OPEN statement that opens a list cursor:

- SQLERRD[1]: Longword length of the longest actual segment
- SQLERRD[3]: Longword number of segments
- SQLERRD[4,5]: Two contiguous longwords contained a quadword number of total bytes

SQL puts no meaningful data in the sixth element of the SQLERRD array after successful execution of a FETCH statement.

SQLERRD[1] on a LIST cursor fetch returns the segment size in octets.

After error statements or any other cases, the value of SQLERRD is undefined.

SQLWARNx
A series of 1-character fields, numbered from 0 through 7, that SQL does not use. It is provided for compatibility with DB2 software.

C.2 The Message Vector

When SQL precompiles a program, it declares a host structure for the message vector immediately following the SQLCA. It calls the structure RDB$MESSAGE_VECTOR.

Programs most often use the message vector in two ways:

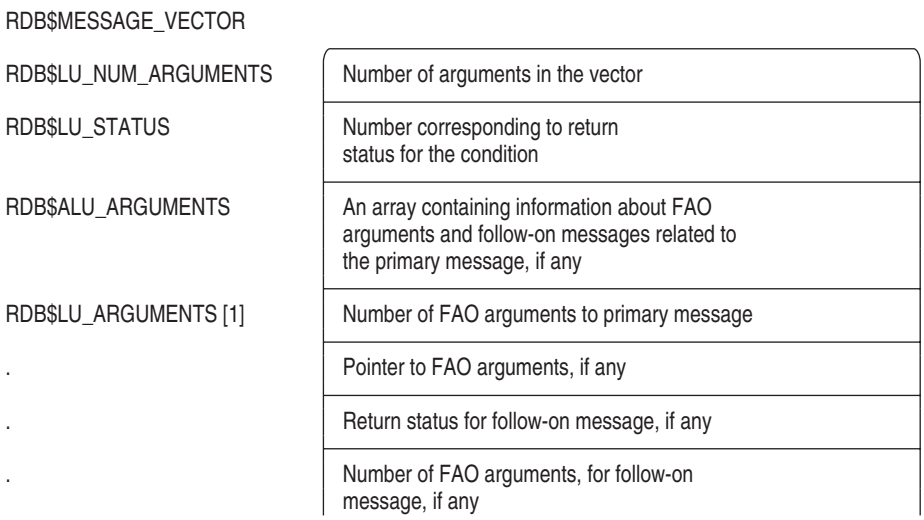
- By checking the message vector field RDB$LU_STATUS for the return status value from the last SQL statement. The program can either check the low-order bit of that field (successful if set) or use the entire field to determine the specific return status value.

- By using the message vector in the sql_signal and sql_get_error_text routines:
  - The sql_signal routine uses the message vector to signal the error to the OpenVMS condition handler.
  - The sql_get_error_text routine puts the message text corresponding to the return status value in the message vector into a buffer the program specifies.

  For more information about sql_signal and sql_get_error_text, see Chapter 5.

Figure C–1 summarizes the fields of the message vector.

Figure C–1 Fields of the Message Vector



C.3 Declarations of the SQLCA and the Message Vector

This section shows the SQLCA and message vector declarations for the host languages supported by the SQL precompiler and module processor.

Example C–3 shows the Ada SQLCA and message vector declaration.

Example C–3 Ada SQLCA and Message Vector Declaration

```
Package SQL_ADA_CURSOR is
TYPE SQL_TYPE_1 IS NEW STRING(1..6);
    type SQLERRM_REC is
        record
            SQLERRML : short_integer;
            SQLERRMC : string (1..70);
        end record;

    type SQLERRD_ARRAY is array (1..6) of integer;

   type SQLCA is
        record
            SQLCAID : string (1..8) := "SQLCA   ";
            SQLABC : integer := 128;
            SQLCODE : integer;
            SQLERRM : sqlerrm_rec;
            SQLERRD : sqlerrd_array;
            SQLWARN0 : character := ' ';
            SQLWARN1 : character := ' ';
            SQLWARN2 : character := ' ';
            SQLWARN3 : character := ' ';
            SQLWARN4 : character := ' ';
            SQLWARN5 : character := ' ';
            SQLWARN6 : character := ' ';
            SQLWARN7 : character := ' ';
            SQLEXT : string (1..8) := "        ";
        end record;

RDB_MESSAGE_VECTOR : SYSTEM.UNSIGNED_LONGWORD_ARRAY(1..20);
pragma PSECT_OBJECT(RDB_MESSAGE_VECTOR,"RDB$MESSAGE_VECTOR");
```

Example C–4 shows the BASIC SQLCA and message vector declaration.

Example C–4 BASIC SQLCA and Message Vector Declaration

```
RECORD SQLCA_REC
    string SQLCAID = 8
    long SQLCABC
    long SQLCODE
    GROUP SQLERRM
      word SQLERRML
      string SQLERRMC = 70
    END GROUP SQLERRM
    long SQLERRD(5)
    string SQLWARN0 = 1
    string SQLWARN1 = 1
```

(continued on next page)

Example C–4 (Cont.) BASIC SQLCA and Message Vector Declaration

```
    string SQLWARN2 = 1
    string SQLWARN3 = 1
    string SQLWARN4 = 1
    string SQLWARN5 = 1
    string SQLWARN6 = 1
    string SQLWARN7 = 1
    string SQLEXT = 8
END RECORD SQLCA_REC

DECLARE SQLCA_REC SQLCA

RECORD  RDB$MESSAGE_VECTOR_REC
    long RDB$LU_NUM_ARGUMENTS
    long RDB$LU_STATUS
    GROUP RDB$ALU_ARGUMENTS(17) ! Arrays in BASIC are always relative
          long RDB$LU_ARGUMENT  ! to 0.  There are 18 array elements.
    END GROUP RDB$ALU_ARGUMENTS
END RECORD RDB$MESSAGE_VECTOR_REC

COMMON (RDB$MESSAGE_VECTOR) &
    RDB$MESSAGE_VECTOR_REC RDB$MESSAGE_VECTOR
```

Example C–5 shows the C SQLCA and message vector declaration.

Example C–5 C SQLCA and Message Vector Declaration

```
struct
    {
        char SQLCAID[8];
        int SQLCABC;
        int SQLCODE;
        struct {
            short SQLERRML;
            char SQLERRMC[70];
               } SQLERRM;
        int SQLERRD[6];
        struct {
            char SQLWARN0[1];
            char SQLWARN1[1];
            char SQLWARN2[1];
            char SQLWARN3[1];
            char SQLWARN4[1];
            char SQLWARN5[1];
            char SQLWARN6[1];
            char SQLWARN7[1];
               } SQLWARN;
        char SQLEXT[8];
    } SQLCA = {         {'S','Q','L','C','A',' ',' ',' '},
                        128, 0,
                        {0, ""},
                        {0,0,0,0,0,0},
                        {"", "", "", "", "", "", "", ""},
                        "" };
extern
struct Rdb$MESSAGE_VECTOR_str
RDB$MESSAGE_VECTOR;
```

Example C–6 shows the COBOL SQLCA and message vector declaration.

Example C–6 COBOL SQLCA and Message Vector Declaration

```
01      SQLCA   GLOBAL.
        02      SQLCAID PIC X(8) VALUE IS "SQLCA   ".
        02      SQLCABC PIC S9(9) COMP VALUE IS 128.
        02      SQLCODE PIC S9(9) COMP.
        02      SQLERRM.
                03      SQLERRML PIC S9(4) COMP VALUE IS 0.
                03      SQLERRMC PIC X(70).
        02      SQLERRD PIC S9(9) COMP  OCCURS 6 TIMES.
        02      SQLWARN.
                03      SQLWARN0 PIC X.
                03      SQLWARN1 PIC X.
                03      SQLWARN2 PIC X.
                03      SQLWARN3 PIC X.
                03      SQLWARN4 PIC X.
                03      SQLWARN5 PIC X.
                03      SQLWARN6 PIC X.
                03      SQLWARN7 PIC X.
        02      SQLEXT PIC X(8).

01 Rdb$MESSAGE_VECTOR EXTERNAL GLOBAL.
    03 Rdb$LU_NUM_ARGUMENTS     PIC S9(9) COMP.
    03 Rdb$LU_STATUS            PIC S9(9) COMP.
    03 Rdb$ALU_ARGUMENTS        OCCURS 18 TIMES.
        05 Rdb$LU_ARGUMENTS     PIC S9(9) COMP.
```

Example C–7 shows the FORTRAN SQLCA and message vector declaration.

Example C–7 FORTRAN SQLCA and Message Vector Declaration

```
        CHARACTER*1 SQLCA (128)
        INTEGER*4 SQLCOD
        EQUIVALENCE (SQLCOD, SQLCA(13))
        INTEGER*2 SQLTXL
        EQUIVALENCE (SQLTXL, SQLCA(17))
        CHARACTER*70 SQLTXT
        EQUIVALENCE (SQLTXT, SQLCA(19))
        INTEGER*4 SQLERR(1:6)
        EQUIVALENCE (SQLERR, SQLCA(89))
        CHARACTER*1 SQLWRN(0:7)
        EQUIVALENCE (SQLWRN, SQLCA(113))
```

(continued on next page)

Example C–7 (Cont.) FORTRAN SQLCA and Message Vector Declaration

```
  INTEGER*4 Rdb$MESSAGE_VECTOR(20), Rdb$LU_NUM_ARGUMENTS
  INTEGER*4 Rdb$LU_STATUS, Rdb$ALU_ARGUMENTS(18)
  COMMON /Rdb$MESSAGE_VECTOR/ Rdb$MESSAGE_VECTOR
  EQUIVALENCE ( Rdb$MESSAGE_VECTOR(1),Rdb$LU_NUM_ARGUMENTS)
  EQUIVALENCE ( Rdb$MESSAGE_VECTOR(2), Rdb$LU_STATUS)
  EQUIVALENCE ( Rdb$MESSAGE_VECTOR(3), Rdb$ALU_ARGUMENTS )
```

Example C–8 shows the Pascal SQLCA and message vector declaration.

Example C–8 Pascal SQLCA and Message Vector Declaration

```
TYPE
 RDB$LU_ARGUMENTS = [HIDDEN] INTEGER;
 RDB$ALU_ARGUMENTS_ARRAY = [HIDDEN] ARRAY [1..18] OF RDB$LU_ARGUMENTS;
 RDB$MESSAGE_VECTOR_REC = [HIDDEN] RECORD
        RDB$LU_NUM_ARGUMENTS    :   INTEGER;
        RDB$LU_STATUS           :   INTEGER;
        RDB$ALU_ARGUMENTS       :   RDB$ALU_ARGUMENTS_ARRAY;
 END;
VAR
 RDB$MESSAGE_VECTOR : [HIDDEN, common(rdb$message_vector) ]
 RDB$MESSAGE_VECTOR_REC;
TYPE
 SQL$SQLCA_REC = [HIDDEN] RECORD
        SQLCAID : PACKED ARRAY [1..8] OF CHAR;
        SQLCABC : INTEGER;
        SQLCODE : INTEGER;
        SQLERRM : RECORD
            SQLERRML : SQL$SMALLINT;
            SQLERRMC : PACKED ARRAY [1..70] OF CHAR;
        END;
```

(continued on next page)

Example C–8 (Cont.) Pascal SQLCA and Message Vector Declaration

```
        SQLERRD : ARRAY [1..6] OF INTEGER;
        SQLWARN : RECORD
            SQLWARN0 : CHAR;
            SQLWARN1 : CHAR;
            SQLWARN2 : CHAR;
            SQLWARN3 : CHAR;
            SQLWARN4 : CHAR;
            SQLWARN5 : CHAR;
            SQLWARN6 : CHAR;
            SQLWARN7 : CHAR;
        END;
        SQLEXT : PACKED ARRAY [1..8] OF CHAR;
 END;
VAR
 RDB$DBHANDLE : [HIDDEN] INTEGER;
 SQLCA : [HIDDEN] SQL$SQLCA_REC;
```

Example C–9 shows the PL/I SQLCA and message vector declaration.

Example C–9 PL/I SQLCA and Message Vector Declaration

```
DCL 1 SQLCA  STATIC ,
     2 SQLCAID character(8) INITIAL('SQLCA   '),
     2 SQLCABC fixed binary(31) INITIAL(128),
     2 SQLCODE fixed binary(31),
     2 SQLERRM ,
      3 SQLERRML fixed binary(15) INITIAL(0),
      3 SQLERRMC character(70),
     2 SQLERRD (1:6) fixed binary(31),
     2 SQLWARN ,
      3 SQLWARN0 character(1),
      3 SQLWARN1 character(1),
      3 SQLWARN2 character(1),
      3 SQLWARN3 character(1),
      3 SQLWARN4 character(1),
      3 SQLWARN5 character(1),
      3 SQLWARN6 character(1),
      3 SQLWARN7 character(1),
     2 SQLEXT character(8);
```

(continued on next page)

Example C–9 (Cont.) PL/I SQLCA and Message Vector Declaration

```
DCL 1 Rdb$MESSAGE_VECTOR EXTERNAL,
     2 Rdb$LU_NUM_ARGUMENTS FIXED BINARY(31),
     2 Rdb$LU_STATUS FIXED BINARY(31),
     2 Rdb$ALU_ARGUMENTS (18),
      3 Rdb$LU_ARGUMENTS FIXED BINARY (31);
```

C.4 Using SQLCA Include Files

Use of the SQLCA include files such as the SQL_SQLCA.H file for C, are intended for use with the host language files only. That is, only *.C should be included in that file. Precompiled files (*.SC files) should use the EXEC SQL INCLUDE SQLCA embedded SQL command in the declaration section of the module. In this way the precompiler can properly define the structure to be used by the related SQL generated code.

Remember that the SQLCA is always scoped at the module level, unlike the SQLCODE or SQLSTATE variables which may be routine specific.

C.5 SQLSTATE

SQL defines a set of status parameters that can be part of the parameter list for a procedure definition in a nonstored module. They are SQLSTATE, SQLCODE, and SQLCA. An SQL procedure is required to contain at least one of these status parameters in its parameter list. All status parameters are implicitly output parameters.

The purpose of these status parameters is to return the status of each SQL statement that is executed. Each status parameter gives information that allows you to determine whether the statement completed execution or an exception has occurred. These status parameters differ in the amount of diagnostic information they supply, when an exception occurs as follows:

- SQLCODE—This is the original SQL error handling mechanism. It is an integer value. SQLCODE differentiates among errors (negative numbers), warnings (positive numbers), successful completion (0), and a special code of 100, which means no data. SQLCODE is a deprecated feature of the ANSI/ISO SQL standard.
- SQLCA—This is an extension of the SQLCODE error handling mechanism. It contains other context information that supplements the SQLCODE value. SQLCA is not part of the ANSI/ISO SQL standard. However, many databases such as DB2 and ORACLE RDBMS have defined proprietary semantics and syntax to implement it.

- SQLSTATE—This is the error handling mechanism for the ANSI/ISO SQL standard. The SQLSTATE value is a character string that is associated with diagnostic information.

This section covers the following SQLSTATE topics:

- Definition of the SQLSTATE status parameter
- Use of the SQLSTATE status parameter

C.5.1 Definition of the SQLSTATE Status Parameter

The value returned in an SQLSTATE status parameter is a string of five characters. It comprises a two-character class value followed by a three-character subclass value. Each class value corresponds to an execution condition such as success, connection exception, or data exception. Each subclass corresponds to a subset of its execution condition. For example, connection exceptions are differentiated by "connection name in use", "connection not open", and "connection failure" categories. A subclass of 000 means there is no subcondition.

Table C–3 shows the SQLSTATE values that SQL has defined with its corresponding execution condition. The SQLSTATE classes beginning with either the characters *R* or *S* are Oracle Rdb-specific SQLSTATE values.

Table C–3 SQLSTATE Status Parameter Values—Sorted by SQLSTATE Class and Subclass

Class /Subclass	Condition	Subcondition
00000	Successful completion	*No subcondition*
01000	Warning	*No subcondition*
01003		Null value eliminated in aggregate function
01004		String data, right truncation
02000	No data	*No subcondition*
08002	Connection exception	Connection name in use
08003		Connection does not exist
08006		Connection failure

(continued on next page)

Table C–3 (Cont.) SQLSTATE Status Parameter Values—Sorted by SQLSTATE Class and Subclass

Class /Subclass	Condition	Subcondition
09000	Trigger action exception	*No subcondition*
20000	Case not found for case statement	*No subcondition*
21000	Singleton select returned more than one value	*No subcondition*
22001	Data exception	String data, right truncation
22002		Null value, no indicator parameter
22003		Numeric value out of range
22004		Null value not allowed
22005		Error in assignment
22006		Invalid fetch orientation
22007		Invalid date-time format
22008		Datetime field overflow
22009		Invalid time displacement value
22010		Invalid indicator parameter value
22011		Substring error
22012		Division by zero
22015		Datetime field overflow
22018		Invalid character value for cast
22019		Invalid escape character
22020		Invalid limit value
22021		Character not in repertoire
22022		Indicator overflow
22023		Invalid parameter value

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Table C–3 (Cont.) SQLSTATE Status Parameter Values—Sorted by SQLSTATE Class and Subclass

Class /Subclass	Condition	Subcondition
22024		C string not terminated
22025		Invalid escape sequence
22027		Trim error
2201B		Invalid regular expression
2200F		Zero length character string
23000	Integrity constraint violation	*No subcondition*
24000	Invalid cursor state	*No subcondition*
25000	Invalid transaction state	*No subcondition*
25001		Active SQL transaction
25006		Read-only SQL transaction
26000	Invalid SQL statement identifier	*No subcondition*
2F000	SQL routine exception	*No subcondition*
2F005		Function did not execute return statement
30000	Invalid SQL statement	*No subcondition*
31000	Invalid target specification value	*No subcondition*
32000	Invalid constraint mode state	*No subcondition*
33000	Invalid SQL descriptor name	*No subcondition*
34000	Invalid cursor name	*No subcondition*
35000	Invalid condition number	*No subcondition*
37000	Database specification syntax error	*No subcondition*
38000	External procedure exception	*No subcondition*
39000	External procedure call exception	*No subcondition*
39001		Invalid SQLSTATE returned
3C000	Ambiguous cursor name	*No subcondition*

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Table C–3 (Cont.) SQLSTATE Status Parameter Values—Sorted by SQLSTATE Class and Subclass

Class /Subclass	Condition	Subcondition
3E000	Invalid catalog name	*No subcondition*
3F000	Invalid schema name	*No subcondition*
42000	Syntax error or access rule violation	*No subcondition*
44000	With check option violation	*No subcondition*
R1001[1]	Lock error exception	Deadlock encountered
R1002[1]		Lock conflict
R2000[1]	Duplicate value not allowed in index	*No subcondition*
R3000[2]	Trigger forced an ERROR statement	*No subcondition*
R4000[1]	Distributed transaction identification error	*No subcondition*
R5000[1]	Attempted to update a read-only table	*No subcondition*
R6000[1]	Metadata no longer available	*No subcondition*
R7000[1]	Table in request not reserved in transaction	*No subcondition*
RR000[1]	Oracle Rdb returned an error	*No subcondition*
S0000[1]	No implicit transaction	*No subcondition*
S1001[1]	Context exception	Bad version in context structure
S1002[1]		Bad type in context structure
S1003[1]		Bad length in context structure
S2000[1]	Row containing list deleted	*No subcondition*
S3000[1]	Invoker was not the definer	*No subcondition*
S4001[1]	Alias exception	Alias unknown
S4002[1]		Alias already declared
S7000[1]	Base system does not support feature being used	*No subcondition*

[1]Oracle Rdb specific SQLSTATE code

[2]Obsolete. Use SQLSTATE 09000 instead

(continued on next page)

Table C–3 (Cont.) SQLSTATE Status Parameter Values—Sorted by SQLSTATE Class and Subclass

Class /Subclass	Condition	Subcondition
S6000[3]	Case not found; WHEN or ELSE not specified	*No subcondition*
S7000[1]	Bad SQL version	*No subcondition*
S5001[1]	Negative length and scale for column	Negative length specified for column
S5002[1]		Negative scale specified for column

[1]Oracle Rdb specific SQLSTATE code

[3]Obsolete. Use SQLSTATE 20000 instead

C.5.2 Use of the SQLSTATE Status Parameter

Table C–3 shows the SQLSTATE classes 00, 01, and 02 as completion conditions of success, warning, and no data respectively. All other classes define exception conditions.

When using embedded SQL, the embedded exception declaration defines the following categories of exceptions:

- NOT FOUND: SQLSTATE class = 02
- SQLWARNING: SQLSTATE class = 01
- SQLEXCEPTION: SQLSTATE class > 02
- SQLERROR: SQLEXCEPTION or SQLWARNING

Example C–10 shows how to declare SQLSTATE as a parameter in a C program and how to evaluate the SQLSTATE value using the string compare function. When you declare SQLSTATE in a C program, you must type SQLSTATE in all uppercase characters.

Example C–10 Declaring SQLSTATE in a C Program

```
char SQLSTATE[6];
long SQLCODE;

main()
{
     EXEC SQL SELECT T_INT INTO :c1 FROM FOUR_TYPES
                WHERE T_DECIMAL = 4.1;
     printf ("SQLCODE should be < 0; its value is %ld\n", SQLCODE);
     printf ("SQLSTATE should be '22002'; its value is %s\n", SQLSTATE);
     if (SQLCODE >= 0 || strncmp (SQLSTATE, "22002", 5) != 0)
       flag = 0;
}
```

You can use the GET DIAGNOSTICS statement to return the SQLSTATE information to your program. For more information, see the GET DIAGNOSTICS Statement.

Note that Oracle Rdb provides a set of include file for the value of SQLSTATE. These file are located in SYS$LIBRARY with the following names:

Table C–4 Include Files for SQLSTATE

File Name	Description
SQLSTATE.BAS	BASIC include file
SQLSTATE.FOR	Fortran include file
SQLSTATE.H	C or C++ header file
SQLSTATE.LIB	COBOL include file
SQLSTATE.PAS	Pascal include file
SQLSTATE.SQL	SQL declare file

In addition a special script (SQLSTATE_TABLE.SQL) is provided to create a table (SQLSTATE_TABLE) in a database and populate it with the values and symbolic names.

Oracle Corporation will periodically add to these definition files as new SQLSTATE values are used by Oracle Rdb, or as required by the ANSI and ISO SQL database standard.

D

The SQL Dynamic Descriptor Areas (SQLDA and SQLDA2)

An SQL Descriptor Area (SQLDA) is a collection of parameters used only in dynamic SQL programs. SQL provides two descriptor areas: SQLDA and SQLDA2. Sections D.6 through D.6.2 include information specific to the SQLDA2.

Dynamic SQL lets programs accept or generate SQL statements at run time, in contrast to SQL statements that are part of the source code for precompiled programs or SQL module language procedures. Unlike precompiled SQL or SQL module language statements, such dynamically executed SQL statements are not necessarily part of a program's source code, but can be generated while the program is running. Dynamic SQL is useful when you cannot predict the type of SQL statement your program will need to process.

To use an SQLDA, host languages must support pointer variables that provide indirect access to storage by storing the address of data instead of directly storing data in the variable. The languages supported by the SQL precompiler that also support pointer variables are PL/I, C, BASIC, and Ada. Any other language that supports pointer variables can use an SQLDA, but must call SQL module procedures containing SQL statements instead of embedding the SQL statements directly in source code.

D.1 Purpose of the SQLDA

The SQLDA provides information about dynamic SQL statements to the program and information about memory allocated by the program to SQL. Specifically, SQL and host language programs use the SQLDA for the following purposes:

- SQL uses the SQLDA as a place to *write* information about parameter markers and select list items in a prepared statement. SQL writes information about the number and data types of input and output parameter markers and select list items to the SQLDA when it processes PREPARE . . . SELECT LIST INTO statements or DESCRIBE statements.

Parameter markers are question marks (?) that denote parameters in the statement string of a PREPARE statement. SQL replaces parameter markers with values in parameters or dynamic memory when it executes a dynamic SQL statement.

The DESCRIBE statement writes information about select list items in a prepared SELECT statement to the SQLDA so the host language program can allocate storage (parameters or dynamic memory) for them. The storage allocated by the program then receives values in rows of the prepared SELECT statement's result table in subsequent FETCH statements.

An SQLDA at any particular time can contain information about either input or output parameter markers or select list items, but not about both:

- SQL writes information about select list items to the SQLDA when it executes DESCRIBE . . . SELECT LIST or PREPARE . . . SELECT LIST statements.
- SQL writes information about parameter markers to the SQLDA when it executes DESCRIBE . . . MARKERS statements. If a prepared statement has no parameter markers, a DESCRIBE . . . MARKERS statement puts values in the SQLDA to indicate that there are no parameter markers.

- The program uses the SQLDA as a place to *read* the information SQL wrote to the SQLDA about any select list items, or input or output parameter markers in the prepared statement:
  - After either a DESCRIBE . . . SELECT LIST or DESCRIBE . . . MARKERS statement, the program reads the number and data type of select list items or parameter markers.

    The program uses that information to allocate storage (either by declaring parameters or allocating dynamic memory) for values that correspond to the parameter markers or select list items.
- The program uses the SQLDA as a place to *write* the addresses of the storage it allocated for parameter markers and select list items.
- SQL uses the SQLDA as a place to *read* information about parameter markers or select list items:
  - In OPEN statements, SQL reads the addresses of a prepared SELECT statement's parameter markers to set up a cursor for the program to process.

- In FETCH statements, SQL reads the addresses of a prepared SELECT statement's select list items so it can write the values of the row being fetched to the storage allocated by the program.
- In EXECUTE statements, SQL reads the addresses of parameter markers of any prepared statement other than a SELECT statement.

The OPEN and FETCH statements used to read information from the SQLDA are not themselves dynamic statements used in a PREPARE statement, nor is a DECLARE CURSOR statement that declares the cursor named in the OPEN and FETCH statements. Although these statements *use* prepared statements, they are among the SQL statements that cannot themselves *be* prepared statements. See the PREPARE Statement for a list of statements that cannot be dynamically executed.

D.2 How SQL and Programs Use the SQLDA

The specific sequence of operations that uses the SQLDA depends on whether a program can accept dynamically generated SELECT statements only, non-SELECT statements only, or both. The following sequence describes in general the steps a program follows in using the SQLDA. For specific examples, see the chapter on using dynamic SQL in the *Oracle Rdb Guide to SQL Programming* and the sample programs created during installation of Oracle Rdb in the Samples directory.

1. The program uses the embedded SQL statement INCLUDE SQLDA to automatically declare an SQLDA. In addition, the program must allocate memory for the SQLDA and set the value of one of its fields, SQLN. The value of SQLN specifies the maximum number of parameter markers or select list items about which information can be stored in the SQLDA.

   Programs can use more than one SQLDA but must explicitly declare additional SQLDA structures with names other than SQLDA. Declaring two SQLDAs can be useful for dynamic SQL programs that can accept both SELECT and non-SELECT statements. One SQLDA stores information about parameter markers and another stores information about select list items. (An alternative to declaring multiple SQLDA structures in such programs is to issue additional DESCRIBE . . . SELECT LIST statements after the program finishes with parameter marker information in the SQLDA.)

   Declaration and allocation of SQLDAs need to be done only once. The remaining steps repeat as many times as the program has dynamic SQL statements to process.

2. SQL writes the number and data types of any select list items (for a DESCRIBE . . . SELECT LIST statement) or parameter markers (for a DESCRIBE . . . MARKERS statement) of a prepared statement into the SQLDA. SQL puts the number of select list items or parameter markers in the SQLD field of the SQLDA, and stores codes denoting their data types in the SQLTYPE fields.

3. If the program needs to determine if a particular prepared statement is a SELECT statement, it reads the value of the second element of the SQLCA.SQLERRD array after a DESCRIBE . . . SELECT LIST statement. If the value is one, the prepared statement is a SELECT statement and the program needs to allocate storage for rows generated during subsequent FETCH statements.

4. When you use parameter markers in SQL statements, you should not make any assumptions about the data types of the parameters. SQL may convert the parameter to a data type that is more appropriate to a particular operation. For example, when you use a parameter marker as one value expression in a LIKE predicate, SQL returns a data type of VARCHAR for that parameter even though the other value expression has a data type of CHAR. The STARTING WITH predicate and the CONTAINING predicate treat parameter markers in the same way. You can override the VARCHAR data type in such predicates by explicitly setting the SQLTYPE field of the SQLDA to CHAR.

5. The program reads information about the number, data type, and length of any select list items (after a DESCRIBE . . . SELECT LIST statement) or parameter markers (after a DESCRIBE . . . MARKERS statement) from the SQLDA. The program then allocates storage (parameters or dynamic memory) for each of the select list items or parameters, and writes the addresses for that storage to the SQLDA. The program puts the addresses into the SQLDATA fields of the SQLDA.

   If SQL uses a data type for the parameter marker or select list item that is not supported by the programming language, the program must convert the SQLTYPE and SQLLEN fields to an appropriate data type and length. The program changes the values of SQLTYPE and SQLLEN that SQL returns from the DESCRIBE statement to a data type and length that both SQL and the host language support.

6. The program supplies values that will be substituted for parameter markers and writes those values to the storage allocated for them.

7. SQL reads information about parameter markers from the SQLDA:

   – If the prepared statement is a prepared SELECT statement, SQL reads the addresses of any parameter markers for that prepared SELECT statement when it executes an OPEN statement that refers to the SQLDA.

   – If the statement is any other prepared statement, SQL reads the addresses of parameter markers for that statement when it executes an EXECUTE statement that refers to the SQLDA.

   SQL uses the addresses of parameter markers to retrieve the values in storage (supplied by the program) and to substitute them for parameter markers in the prepared statement.

8. Finally, for prepared SELECT statements only, SQL reads the addresses of select list items when it executes a FETCH statement that refers to the SQLDA. SQL uses the information to write the values from the row of the result table to memory.

D.3 Declaring the SQLDA

Programs can declare the SQLDA in the following ways:

- By using the INCLUDE SQLDA statement embedded in Ada, C, or PL/I programs to be precompiled. The INCLUDE SQLDA statement automatically inserts a declaration of an SQLDA structure, called SQLDA, in the program when it precompiles the program.
- In precompiled Ada programs, by specifying the SQLDA_ACCESS type in the SQL definition package. Specifying SQLDA_ACCESS offers an advantage over an embedded INCLUDE SQLDA statement because you can use it in more than one declaration to declare multiple SQLDA structures.
- In precompiled C programs and C host language programs, you can use the sql_sqlda.h header file. The following example shows how to include the file in a C program:

  ```
  #include <sql_sqlda.h>
  ```

  The sql_sqlda.h header file includes typedef statements for the SQLDA structure defining the SQL_T_SQLDA (or the SQL_T_SQLDA2) data type. In addition, it defines the SQL_T_SQLDA_FULL (or SQL_T_SQLDA2_FULL) data type as a superset to the definition of the SQLDA structure. The SQL_T_SQLDA_FULL data type is identical in layout to the SQL_T_SQLDA data type except that it contains additional unions with additional fields that SQL uses when describing CALL statements.

For additional information on declaring SQLDA structures, see the *Oracle Rdb Guide to SQL Programming*.

- By explicitly declaring the SQLDA in programs written in host languages that support pointer variables. Such host languages can then take advantage of dynamic SQL even though the SQL precompiler does not support them. Instead of embedding SQL statements directly in the host language source code, languages unsupported by the precompiler must call SQL module language procedures that contain SQL statements to use dynamic SQL. See Chapter 3 for more information about the SQL module language.

  Programs that explicitly declare SQLDA structures (whether or not they have precompiler support) supply a name for the SQLDA structure, which can be SQLDA or any other valid name. Declaring two SQLDAs can be useful for dynamic SQL programs that can accept both SELECT and non-SELECT statements. One SQLDA stores information about parameter markers and another stores information about select list items.

An SQLDA always includes four fields, and may sometimes include a fifth field. The fifth field, SQLVAR, is a repeating field. For languages other than C, it comprises five parameters that describe individual select list items or parameter markers of a prepared statement. For C, it comprises six parameters.

The following examples show declarations of the SQLDA for different host languages. For PL/I, C, and Ada, the examples show the declaration SQL inserts when it processes a program that contains the INCLUDE SQLDA statement. For BASIC, the example shows the format a program should use when it declares the SQLDA explicitly.

These sample declarations all use the name SQLDA as the name for the SQLDA structure, but programs can use any valid name.

Example D–1 shows the declaration that SQL inserts when it processes a program that contains the INCLUDE SQLDA statement.

Example D–1 Declaration of the SQLDA in Ada

```
type SQLNAME_REC is
    record
        NAME_LEN : standard.short_integer;
        NAME_STR : standard.string (1..30);
    end record;

type SQLVAR_REC is
    record
        SQLTYPE : standard.short_integer;
        SQLLEN : standard.short_integer;
        SQLDATA : system.address;
        SQLIND : system.address;
        SQLNAME : sqlname_rec;
    end record;
type SQLVAR_ARRAY is array (1..255) of sqlvar_rec;

type SQLDA_RECORD;
type SQLDA_ACCESS is access SQLDA_RECORD;
type SQLDA_RECORD is
    record
        SQLDAID : standard.string (1..8) := 'SQLDA   ';
        SQLDABC : standard.integer;
        SQLN : standard.short_integer;
        SQLD : standard.short_integer;
        SQLVAR : sqlvar_array;
    end record;
```

Example D–2 shows the format that BASIC programs should use when they explicitly declare the SQLDA.

Example D–2 Declaration of the SQLDA in BASIC

```
RECORD  SQLDA_REC
   string SQLDAID = 8
   long SQLDABC
   word SQLN              ! Program must explicitly
   word SQLD              ! set SQLN equal to the number
   GROUP SQLVAR(100)      ! of occurrences of SQLVAR
      word SQLTYPE
      word SQLLEN
      long SQLDATA
      long SQLIND
```

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Example D–2 (Cont.) Declaration of the SQLDA in BASIC

```
      GROUP SQLNAME
         word SQLNAME
         string SQLNAMEC = 30
      END GROUP SQLNAME
   END GROUP SQLVAR
END RECORD SQLDA_REC

DECLARE SQLDA_REC SQLDA
```

Example D–3 shows the declaration that SQL inserts when it processes a C program that contains the INCLUDE SQLDA statement.

Example D–3 Declaration of the SQLDA in C

```
struct SQLDA_STRUCT {
          char SQLDAID[8];
          int SQLDABC;
          short SQLN;
          short SQLD;
          struct SQLVAR_STRUCT {
            short SQLTYPE;
            short SQLLEN;
            char *SQLDATA;
            short *SQLIND;
            short SQLNAME_LEN;
            char SQLNAME[30];
               } SQLVAR[1];
          } *SQLDA;
```

Example D–4 shows the declaration that SQL inserts when it processes a PL/I program that contains the INCLUDE SQLDA statement.

Example D–4 Declaration of the SQLDA in PL/I

```
/*
    EXEC SQL INCLUDE SQLDA;
*/
DCL 1 SQLDA BASED ( SQLDAPTR ),
     2 SQLDAID  CHAR(8),
     2 SQLDABC  BIN FIXED(31),
     2 SQLN  BIN FIXED(15),
     2 SQLD  BIN FIXED(15),
     2 SQLVAR  (SQLSIZE REFER(SQLN)),
      3 SQLTYPE  BIN FIXED(15),
      3 SQLLEN  BIN FIXED(15),
      3 SQLDATA  PTR,
      3 SQLIND  PTR,
      3 SQLNAME  CHAR(30) VAR;
DCL SQLSIZE BIN FIXED;
DCL SQLDAPTR PTR;
```

D.4 Description of Fields in the SQLDA

Table D–1 describes the different fields of the SQLDA and the ways SQL uses the fields. Remember that the SQLDA, at any particular time, can contain information about either select list items or parameter markers, but not both.

Table D–1 Fields in the SQLDA

Field Name	Meaning of the Field	Set by	Used by
SQLDAID	Character string field whose value is always the character string "SQLDA".	SQL	Not used.
SQLDABC	The length in bytes of the SQLDA, which is a function of SQLN (SQLDABC = 16 + (44 * SQLN)).	SQL	Not used.
SQLN	The total number of occurrences of the SQLVAR group field (the value must equal or exceed the value in SQLD, or the DESCRIBE statement). Generates a run-time error.	Program	SQL to determine if a program allocated enough storage for the SQLDA.

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Table D–1 (Cont.) Fields in the SQLDA

Field Name	Meaning of the Field	Set by	Used by
SQLD	Number of output items (if DESCRIBE . . . OUTPUT) or parameter markers (if DESCRIBE . . . INPUT) in prepared statement (if none, the value is 0).	SQL	Program to determine how many input or output parameters for which to allocate storage.
SQLVAR	A repeating group field, each occurrence of which describes a select list item or parameter marker (not used if the value of SQLD is 0).	No value	See descriptions of subfields in the following entries.

SQLVAR Subfields (Each Occurs Once for Each Select List Item or Parameter Marker)

Field Name	Meaning of the Field	Set by	Used by
SQLTYPE	A subfield of SQLVAR whose value indicates the data type of the select list item or parameter marker (see Table D–2).	SQL	Program to allocate storage with the appropriate data type for the parameter.
SQLLEN	A subfield of SQLVAR whose value indicates the length in bytes of the select list item or parameter marker. For CHAR[1] and CHARACTER VARYINGR[1], indicates the declared length of the data without length field overhead. For fixed-length data types (TINYINT, SMALLINT, INTEGER, BIGINT, and DECIMAL), SQLLEN is split in half. For TINYINT, SMALLINT, INTEGER, and BIGINT, the low-order byte of SQLLEN indicates the length, and the high-order byte indicates the scale (the number of digits to the right of the decimal point).	SQL unless program resets, except DECIMAL or H_FLOAT, which can only be set by user	Program to allocate storage with the appropriate size for the select list item or parameter marker.

[1]Includes CHARACTER, NATIONAL CHARACTER

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Table D–1 (Cont.) Fields in the SQLDA

SQLVAR Subfields (Each Occurs Once for Each Select List Item or Parameter Marker)			
Field Name	**Meaning of the Field**	**Set by**	**Used by**
	For DECIMAL, the low-order byte indicates the precision, and the high-order byte indicates the scale. However, the SQLLEN for a DECIMAL data type can be set only by the user; it is not returned by SQL on a DESCRIBE statement. List cursors cannot return data in data types that require a scale factor. For floating-point data types, the SQLLEN shows the length of the field in bytes so that SQLLEN = 4 indicates the REAL data type, SQLLEN = 8 indicates DOUBLE PRECISION, and SQLLEN = 16 indicates the H_FLOAT data type. The floating point representation of the data (VAX versus IEEE) is determined by the /FLOAT qualifier on the SQL$PRE command line.		
SQLDATA	A subfield of SQLVAR whose value is the address of the storage allocated for the select list item or parameter marker. For CHARACTER VARYING [2], allocate sufficient memory to allow the length field (that is, SQLLEN plus two octects).	Program	SQL: • In EXECUTE and OPEN statements, to retrieve a value stored by the program and substitute it for a parameter marker in the prepared statement. • In FETCH statements, to store a value from a result table.

[2]Includes VARCHAR, VARCHAR2, NATIONAL CHARACTER, VARYING, RAW, and LONG VARCHAR

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Table D–1 (Cont.) Fields in the SQLDA

SQLVAR Subfields (Each Occurs Once for Each Select List Item or Parameter Marker)			
Field Name	**Meaning of the Field**	**Set by**	**Used by**
SQLIND	A subfield of SQLVAR whose value is the address of the indicator variable, a word (16 bits) in size (if program does not set SQLIND, the value is 0).	Program	Program or SQL: • In FETCH statements, by SQL, to store the value for an indicator variable associated with a select list item. • After FETCH statements, by the program. to retrieve the value of a select list item's associated indicator variable. • In EXECUTE and OPEN statements, by SQL, to retrieve the value of a parameter marker's associated indicator variable.
SQLNAME[1]	A varying character string subfield of SQLVAR whose value is: For output items, the name of the column in the select list of the prepared SELECT statement. For input, the name of the column to which a parameter marker is assigned (in INSERT or UPDATE statements) or compared (in basic predicates). If the select list item, assignment, or comparison involves an arithmetic expression or predicates other than basic predicates; SQL does not assign a value to SQLNAME.	SQL	The program, optionally, to find out the name of the column associated with a select list item or parameter marker.

[1]Includes CHARACTER, NATIONAL CHARACTER

Table D–2 shows the numeric and literal values for the SQLTYPE subfield of SQLVAR and the meaning of those values.

Table D–2 Codes for SQLTYPE Field of SQLDA and SQLDA2

Numeric Value	Literal Value	Data Type
449	SQLDA_VARCHAR	VARCHAR[1], CHARACTER VARYING
453	SQLDA_CHAR	CHAR, CHARACTER
481	SQLDA_FLOAT	FLOAT[5], REAL, DOUBLE PRECISION
485	SQLDA_DECIMAL	DECIMAL
497	SQLDA_INTEGER	INTEGER
501	SQLDA_SMALLINT	SMALLINT
503	SQLDA_DATE	DATE VMS
505	SQLDA_QUADWORD	BIGINT
507	SQLDA_ASCIZ	ASCIZ[2]
509	SQLDA_SEGSTRING	LIST OF BYTE VARYING
515	SQLDA_TINYINT	TINYINT
516	SQLDA_VARBYTE	VARBYTE[3,4]
519	SQLDA2_DATETIME	Date-time (ANSI)
521	SQLDA2_INTERVAL	INTERVAL

[1]For the SQLDA2 structure, this data type has a longword length prefix.

[2]The SQLTYPE code for ASCIZ is never returned in the SQLDA by a DESCRIBE statement, but it can be used to override the data type that is returned.

[3]This data type value is only valid for fetches of list elements.

[4]This data type does not allow null values.

[5]The floating point representation assumed by SQL for the floating point number is determined by the /FLOAT qualifier on the SQL$MOD or SQL$PRE command line.

SQL provides a file that contains the declarations of all the SQLTYPE literal values. Table C–2 shows how to include this file in precompiled SQL and module language programs.

There is some confusion over the use of ASCII and ASCIZ in dynamic SQL and C programs. When a CHAR data type is written to the database using INSERT or UPDATE, the string is not padded with blank spaces. It contains a null-terminated character, which makes it difficult to access the data.

SQL does not know what the host language is when using dynamic SQL; it returns the data type of the field as in the DESCRIBE statement, (CHAR(n)), and not the data type of the user's host variable. The interpretation of CHAR(n) being ASCIZ is for host variables and not database variables.

If you change the SQLDA's SQLTYPE from CHAR to ASCIZ and increase SQLLEN by 1, no truncation occurs and the CHAR STRING fields will be padded with blank spaces accordingly (where incrementing SQLLEN by 1 accounts for the null terminator).

Note

SQL sets the value of SQLTYPE during the DESCRIBE statement. However, your application program can change the value of SQLTYPE to that of another data type.

For example, SQL does not support the DECIMAL data type in database columns. This means that SQL will never return the code for the DECIMAL data type in the SQLTYPE field in the SQLDA. However, programs can set the code to that for DECIMAL, and SQL will convert data from databases to DECIMAL, and data from DECIMAL parameters in the program to the data type in the database.

However, SQL assumes that program parameters will correspond to the data type indicated by the SQLTYPE code. If they do not, SQL may generate unpredictable results.

D.5 Parameters Associated with the SQLDA: SQLSIZE and SQLDAPTR

In addition to the declaration of the SQLDA itself, SQL declares two related parameters: SQLSIZE and SQLDAPTR. These parameters can only be used in PL/I programs. The PL/I program uses both parameters when it dynamically allocates storage for the SQLDA before a DESCRIBE or PREPARE . . . SELECT LIST INTO statement. Your program must:

- Assign a value to SQLSIZE and then assign the same value to SQLN. Because the declaration of the SQLDA refers both to SQLSIZE and SQLN, the program uses that value when it allocates memory for the SQLDA.
- Dynamically allocate memory for the SQLDA based on the value assigned to SQLN, and assign the address for memory used by the SQLDA into SQLDAPTR.

The following program fragment shows how a PL/I program uses SQLSIZE and SQLDAPTR to allocate storage for the SQLDA:

```
#include <stdlib.h>
#define SQLVAR_ELEMENTS 20

/* Declare the SQL Descriptor Area: */
exec sql
    include SQLDA;

/* Allocate memory for the SQLDA and
 * set the value of its SQLN field:
 */
SQLDA = malloc (16 + 44 * SQLVAR_ELEMENTS);
SQLDA->SQLN = SQLVAR_ELEMENTS;
```

D.6 Purpose of the SQLDA2

SQL provides an extended version of the SQLDA, called the SQLDA2, which supports additional fields and field sizes.

You can use either the SQLDA or SQLDA2 in any dynamic SQL statement that calls for a descriptor area. SQL assumes default values for SQLDA2 fields and field sizes if you use an SQLDA structure to provide input parameters for an application; however, SQL issues an error message if the application cannot represent resulting values.

Use the SQLDA2 instead of the SQLDA when any of the following applies to the parameter markers or select list items:

- The length of the column name is greater than 30 octets. (An octet is 8 bits.)
- The data type of the column is DATE, DATE VMS, DATE ANSI, TIME, TIMESTAMP, or any of the interval data types.
- The data type is CHAR, CHAR VARYING, CHARACTER, CHARACTER VARYING, VARCHAR, LONG VARCHAR, or RAW and any of the following is true:
  - The character set is not the default 8-bit character set.
  - The maximum length in octets exceeds 32,767.

You can examine the SQLDA2 after SQL fills in the items on a PREPARE statement. Oracle Rdb recommends this rather than setting the fields yourself.

Use one of the following methods to extract the data for your own use:

- The CAST function to convert the data to TEXT before using it
- The EXTRACT function to extract individual fields so you can format it

- The CAST function to convert to DATE VMS so that you can use OpenVMS system services

The ANSI/ISO SQL standard specifies that the data is always returned to the application program as CHAR data.

D.6.1 Declaring the SQLDA2

Programs can declare the SQLDA2 in the same way as they declare an SQLDA, described in Section D.3.

To indicate to SQL that the structure is an SQLDA2 instead of an SQLDA, your program must set the SQLDAID field to be the character string containing the word SQLDA2 followed by two spaces.

The following examples show declarations of the SQLDA2 for different host languages. For PL/I, C, and Ada, the examples show the declaration SQL inserts when it processes a program that contains the INCLUDE SQLDA statement. For other languages, the examples show the format that programs should use when they explicitly declare the SQLDA.

Example D–5 shows the declaration that SQL inserts when it processes an Ada program that contains the INCLUDE SQLDA2 statement. In this example, *N* stands for the maximum number of occurrences of SQLVAR2.

Example D–5 Declaration of the SQLDA2 in Ada

```
type SQLNAME_REC is
    record
        NAME_LEN : standard.short_integer;
        NAME_STR : standard.string (1..128);
    end record;
type SQLVAR_REC is
    record
        SQLTYPE : standard.short_integer;
        SQLLEN : standard.integer;
        SQLDATA : system.address;
        SQLIND : system.address;
        SQLCHRONO_SCALE: standard.integer;
        SQL_CHRONO_PRECISION: standard.integer;
        SQLNAME : sqlname_rec;
        SQLCHAR_SET_NAME : standard.string(1..128);
        SQLCHAR_SET_SCHEMA : standard.string(1..128);
        SQLCHAR_SET_CATALOG : standard.string(1..128);
    end record;
type SQLVAR_ARRAY is array (1..N) of sqlvar_rec;
```

(continued on next page)

Example D–5 (Cont.) Declaration of the SQLDA2 in Ada

```
type SQLDA_RECORD;
type SQLDA_ACCESS is access SQLDA_RECORD;
type SQLDA_RECORD is
    record
        SQLDAID : standard.string (1..8) := 'SQLDA2  ';
        SQLDABC : standard.integer;
        SQLN : standard.short_integer;
        SQLD : standard.short_integer;
        SQLVAR : sqlvar_array;
    end record;
```

Example D–6 shows the format that BASIC programs should use when they explicitly declare the SQLDA2.

Example D–6 Declaration of the SQLDA2 in BASIC

```
RECORD  SQLDA_REC
   string SQLDAID = 8     ! Value must be "SQLDA2  ".
   long SQLDABC
   word SQLN              ! Program must explicitly
   word SQLD              ! set SQLN equal to the number
   GROUP SQLVAR(N)        ! of occurrences of SQLVAR.
      word SQLTYPE
      long SQLLEN
      long SQLOCTET_LEN
      long SQLDATA
      long SQLIND
      long SQLCHRONO_SCALE
      long SQLCHRONO_PRECISION
      GROUP SQLNAME
         word SQLNAME
         string SQLNAMEC = 128
      END GROUP SQLNAME
      string SQLCHAR_SET_NAME = 128
      string SQLCHAR_SET_SCHEMA = 128
      string SQLCHAR_SET_CATALOG = 128
   END GROUP SQLVAR
END RECORD SQLDA_REC

DECLARE SQLDA_REC SQLDA2
```

Example D–7 shows the declaration that SQL inserts when it processes a C program that contains the INCLUDE SQLDA2 statement.

Example D–7 Declaration of the SQLDA2 in C

```
struct SQLDA_STRUCT {
          char SQLDAID[8];  /*Value must be "SQLDA2  "*/
          int SQLDABC;      /* ignored. */
          short SQLN;
          short SQLD;
          struct {
            short SQLTYPE;
            long  SQLLEN;
            long  SQLOCTET_LEN
            char  *SQLDATA;
            long  *SQLIND;
            long  SQLCHRONO_SCALE
            long  SQLCHRONO_PRECISION
            short SQLNAME_LEN;
            char SQLNAME[128];
            char SQLCHAR_SET_NAME[128];
            char SQLCHAR_SET_SCHEMA[128];
            char SQLCHAR_SET_CATALOG[128];
          } SQLVAR[N];          /* N is maximum number of */
        } *SQLDA;                          /* occurrences of SQLVAR. */
```

D.6.2 Description of Fields in the SQLDA2

The SQLVAR2 field for an SQLDA2 structure comprises the following parameters that describe individual select list items or parameter markers of a prepared statement:

- Length (SQLLEN and SQLOCTET_LEN fields)

Note

There is a major difference between the SQLLEN fields in the SQLDA and the SQLDA2. In the SQLDA, the SQLLEN field contains the length of the field in bytes. In the SQLDA2, the SQLLEN field either contains the length of the field in characters or is a subtype field for certain data types (INTERVAL and LIST OF BYTE VARYING). This is the case when you issue the DESCRIBE statement to return information from SQL to your program.

The SQLOCTET_LEN field in the SQLDA2 is analogous to the SQLLEN field in the SQLDA. Use SQLOCTET_LEN instead of

SQLLEN to allocate dynamic memory for the SQLDATA field when using the SQLDA2.

- Data type (SQLTYPE)
- Scale and precision (SQLLEN or SQLCHRONO_SCALE and SQLCHRONO_PRECISION)
- Character set information (SQLCHAR_SET_NAME, SQLCHAR_SET_SCHEMA, SQLCHAR_SET_CATALOG)
- Data value (SQLDATA)
- Null indicator value (SQLIND)
- Name for resulting columns of a cursor specification (SQLNAME)

Table D–3 describes the different fields of the SQLDA2 and the ways in which SQL uses the fields when passing them to dynamic SQL. Remember that the SQLDA2 at any particular time can contain information about either select list items or parameter markers, but not both.

Table D–3 Fields in the SQLDA2

Field Name	Meaning of the Field	Set by	Used by
SQLDAID	Character string field whose value is always the character string "SQLDA2 " (SQLDA2 followed by two spaces).	Program	SQL to determine if the structure is an SQLDA or an SQLDA2.
SQLDABC	The length in bytes of the SQLDA2, which is a function of SQLN (SQLDABC = 16+ (540 * SQLN)).	SQL	Not used.
SQLN	The total number of occurrences of the SQLVAR2 group field (the value must equal or exceed the value in SQLD or the DESCRIBE or PREPARE OUTPUT INTO statement). Generates a run-time error.	Program	SQL to determine if program allocated enough storage for the SQLDA.

(continued on next page)

Table D–3 (Cont.) Fields in the SQLDA2

Field Name	Meaning of the Field	Set by	Used by
SQLD	Number of select list items (if DESCRIBE . . . OUTPUT) or parameter markers (if DESCRIBE . . . INPUT) in prepared statement (if none, the value is 0).	SQL	Program to determine how many input or output parameters for which to allocate storage.
SQLVAR2	A repeating group field, each occurrence of which describes a select list item or parameter marker (not used if the value of SQLD is 0).	No value	See descriptions of subfields in following entries.

SQLVAR2 Subfields (Each Occurs Once for Each Select List Item or Parameter Marker):

Field Name	Meaning of the Field	Set by	Used by
SQLTYPE	A subfield of SQLVAR2 whose value indicates the data type of the select list item or parameter marker (see Table D–2).	SQL	Program to allocate storage with the appropriate data type for the parameter.
SQLLEN	A subfield of SQLVAR2 whose value indicates the length of the select list item or parameter marker.	SQL, unless the program resets, except for DECIMAL, which can only be set by the user.	
	For character types, CHAR, CHARACTER VARYING types SQLLEN indicates the declared size, not including length overheads. See SQLOCTET_LEN.		
	For fixed-length data types (TINYINT, SMALLINT, INTEGER, BIGINT, NUMERIC, and DECIMAL), SQLLEN is split in half.		
	SQLSIZE—the low-order 16 bits		
	• For TINYINT, SMALLINT, INTEGER, and BIGINT; SQLSIZE and SQLOCTET_ LENGTH indicate the length in bytes of the select list item or parameter marker.		
	• For DECIMAL; SQLSIZE indicates the precision. However, the SQLLEN for a DECIMAL data type can only be set by the user; it is not returned by SQL on a DESCRIBE statement.		

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Table D–3 (Cont.) Fields in the SQLDA2

SQLVAR2 Subfields (Each Occurs Once for Each Select List Item or Parameter Marker):			
Field Name	**Meaning of the Field**	**Set by**	**Used by**
	SQLSCALE—the high-order 16 bits • SQLSCALE indicates the scale (the number of digits to the right of the decimal point). • List cursors cannot return data in data types that require a scale factor. For floating-point data types, SQLLEN and SQLOCTET_LEN are the size in octets of the select list item or parameter marker. For DATE, DATE ANSI, DATE VMS, TIME, or TIMESTAMP, SQLLEN is the length of the date-time data type. For INTERVAL data types, SQLLEN is set to one of the codes specified in Table D–4.		Program to allocate storage with the appropriate size for the select list item or parameter marker.
SQLOCTET_LEN	A subfield of SQLVAR2 whose value indicates the length in octets of the select list item or parameter marker. If SQLTYPE indicates CHAR[1], then SQLOCTET_LEN is the maximum possible length in octets of the character string. If SQLTYPE[2] indicates CHARACTER VARYING, SQLOCTET_LEN is the maximum possible length in octets required to represent the character string, including the octets required to represent the string length (that is, 4 additional octets.) If SQLTYPE indicates a fixed-scale or floating-point numeric data type, SQLOCTET_LEN is the size in octets of the numeric select list item or parameter marker. If SQLTYPE indicates a date-time or interval data type, then dynamic SQL ignores SQLOCTET_LEN.	SQL, unless the program resets.	Program or SQL.

[1]Includes CHARACTER, NATIONAL CHARACTER

[2]Includes VARCHAR, VARCHAR2, NATIONAL CHARACTER, VARYING, RAW, and LONG VARCHAR

(continued on next page)

Table D–3 (Cont.) Fields in the SQLDA2

SQLVAR2 Subfields (Each Occurs Once for Each Select List Item or Parameter Marker):

Field Name	Meaning of the Field	Set by	Used by
SQLCHRONO_ SCALE	A longword subfield of SQLVAR2 whose value indicates the specific date-time data type of the column. When SQLTYPE represents a date-time data type, SQLCHRONO_SCALE contains a code specified in Table D–5. When SQLTYPE represents an interval data type, SQLCHRONO_SCALE contains the implied or specified interval leading field precision. When SQLTYPE represents a data type that is neither date-time nor interval, SQLCHRONO_ SCALE contains 0.	SQL, unless the program resets.	Program.
SQLCHRONO_ PRECISION	A longword subfield of SQLVAR2 whose value indicates the precision of the column represented by SQLVAR2 when that column has a date-time data type. When SQLTYPE represents a TIME or TIMESTAMP data type, SQLCHRONO_ PRECISION contains the time precision or timestamp precision. When SQLTYPE represents an interval data type with a fractional seconds precision, SQLCHRONO_PRECISION is set to that value. Otherwise, SQLCHRONO_PRECISION is set to 0.	SQL, unless the program resets.	Program.
SQLCHAR_SET_ NAME	A 128-byte subfield of SQLVAR2 whose value is the character set name if SQLTYPE is a character string type, and spaces if SQLTYPE is any other data type.	SQL, unless the program resets.	The SQLCHAR_SET_NAME field indicates the character set name of a select list item or parameter marker if the select list item or parameter marker has a character data type. Table D–6 shows the possible values for the SQLCHAR_SET_ NAME field when the SQLTYPE indicates one of the character data types.

(continued on next page)

Table D–3 (Cont.) Fields in the SQLDA2

SQLVAR2 Subfields (Each Occurs Once for Each Select List Item or Parameter Marker):

Field Name	Meaning of the Field	Set by	Used by
SQLCHAR_SET_ SCHEMA	A 128-byte subfield of SQLVAR2 whose value is the character set of the schema name if SQLTYPE is a character string type, and spaces if SQLTYPE is any other data type.	Reserved for future use.	Reserved for future use.
SQLCHAR_SET_ CATALOG	A 128-byte subfield of SQLVAR2 whose value is the character set of the catalog name if SQLTYPE is a character string type, and spaces if SQLTYPE is any other data type.	Reserved for future use.	Reserved for future use.
SQLDATA	A subfield of SQLVAR2 whose value is the address of the storage allocated for the select list item or parameter marker. Use SQLOCTET_LEN to allocate memory for this pointer.	Program.	SQL: • In EXECUTE and OPEN statements, to retrieve a value stored by the program and substitute it for a parameter marker in the prepared statement. • In FETCH statements, to store a value from a result table.
SQLIND	A subfield of SQLVAR2 whose value is the address of a longword indicator variable, a longword (32 bits) in size (if the program does not set an indicator variable, the value is 0).	Program.	Program or SQL: • In FETCH statements, by SQL to store the value for an indicator variable associated with a select list item. • After FETCH statements, by program to retrieve the value of a select list item's associated indicator variable. • In EXECUTE and OPEN statements, by SQL to retrieve the value of a parameter marker's associated indicator variable.

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Table D–3 (Cont.) Fields in the SQLDA2

SQLVAR2 Subfields (Each Occurs Once for Each Select List Item or Parameter Marker):			
Field Name	**Meaning of the Field**	**Set by**	**Used by**
SQLNAME	A varying character string subfield of SQLVAR2 whose value is: • For select list items, the name of the column in the select list of the prepared SELECT statement. • For parameter markers, the name of the column to which a parameter marker is assigned (in INSERT or UPDATE statements) or compared (in basic predicates).		
	If the select list item, assignment, or comparison involves an arithmetic expression or predicates other than basic predicates, SQL does not assign a value to SQLNAME.	SQL.	Program, optionally, to find out the name of the column associated with a select list item or parameter marker.
SQLNAME_LEN	A subfield of SQLVAR2 whose value is the length in octets of the column named by SQLNAME.		

Table D–4 shows the possible values for the SQLLEN field when the SQLTYPE indicates one of the interval data types.

Table D–4 Codes for Interval Qualifiers in the SQLDA2

Code	Interval Qualifier	Interval Subtype
1	YEAR	SQLDA2_DT_YEAR
2	MONTH	SQLDA2_DT_MONTH
3	DAY	SQLDA2_DT_DAY
4	HOUR	SQLDA2_DT_HOUR
5	MINUTE	SQLDA2_DT_MINUTE
6	SECOND	SQLDA2_DT_SECOND
7	YEAR TO MONTH	SQLDA2_DT_YEAR_MONTH
8	DAY TO HOUR	SQLDA2_DT_DAY_HOUR
9	DAY TO MINUTE	SQLDA2_DT_DAY_MINUTE
10	DAY TO SECOND	SQLDA2_DT_DAY_SECOND
11	HOUR TO MINUTE	SQLDA2_DT_HOUR_MINUTE
12	HOUR TO SECOND	SQLDA2_DT_HOUR_SECOND
13	MINUTE TO SECOND	SQLDA2_DT_MINUTE_SECOND

Table D–5 shows the possible values for the SQLCHRONO_SCALE field when SQLTYPE indicates the data type DATE, DATE ANSI, DATE VMS, TIME or TIMESTAMP.

Table D–5 Codes for Date-Time Data Types in the SQLDA2

Code	Date-Time Data Type	Date-Time Subtypes
1	DATE ANSI	SQLDA2_DT_DATE
2	TIME	SQLDA2_DT_TIME
3	TIMESTAMP	SQLDA2_DT_TIMESTAMP
4	TIME WITH TIME ZONE	SQLDA2_DT_TIME_TZ
5	TIMESTAMP WITH TIME ZONE	SQLDA2_DT_TIMESTAMP_TZ

Table D–6 shows the possible values for the SQLCHAR_SET_NAME field when the SQLTYPE indicates one of the character data types.

Table D–6 Values for the SQLCHAR_SET_NAME Field

Character Set Value	Description
DEFAULT	Database default character set
GB18030	PRC Simplified Chinese
NATIONAL	National character set
UNSPECIFIED	The character set is unspecified. SQL does not check for compatibility of data.
name-of-cset	See Table 2-1 in Volume 1 for a list of supported character set names.

E

Logical Names Used by SQL

Table E–1 lists the logical names that SQL recognizes for special purposes.

Table E–1 Summary of SQL Logical Names

Logical Name	Function
RDB$CHARACTER_SET	Specifies the database default and national character sets in addition to the session default, identifier, literal, and national character sets. Table E–2 shows the valid equivalence names for the logical name. The logical name is used by the EXPORT and IMPORT statements and by the SQL precompiler and SQL module language to allow compatibility of most recent versions with earlier versions of Oracle Rdb. This logical name sets the attributes for the default connection. This logical name is also deprecated and will not be supported in a future release.
RDB$LIBRARY	Specifies a protected library that you can use to store external routine images, such as external functions. Oracle Rdb recommends that you manage public or sensitive external routine images using a protected library that is referenced by the logical name RDB$LIBRARY. You should define RDB$LIBRARY as an executive mode logical name in the system logical name table. If the external routine image is located in the protected area, you can ensure that the desired image is used by specifying the RDB$LIBRARY logical name with an explicit file name in the LOCATION clause plus the WITH SYSTEM LOGICAL_NAME TRANSLATION clause in a CREATE FUNCTION statement.
RDB$ROUTINES	Specifies the location of an external routine image. If you do not specify a location clause in a CREATE FUNCTION, CREATE PROCEDURE, or CREATE MODULE statement, or if you specify the DEFAULT LOCATION clause, SQL uses the RDB$ROUTINES logical name as the default image location.
RDMS$BIND_OUTLINE_MODE	When multiple outlines exist for a query, this logical name is defined to select which outline to use.
RDMS$BIND_QG_CPU_TIMEOUT	Specifies the amount of CPU time used to optimize a query for execution.

(continued on next page)

Table E–1 (Cont.) Summary of SQL Logical Names

Logical Name	Function
RDMS$BIND_QG_REC_LIMIT	Specifies the number of rows that SQL fetches before the query governor stops output.
RDMS$BIND_QG_TIMEOUT	Specifies the number of seconds that SQL spends compiling a query before the query governor aborts that query.
RDMS$BIND_SEGMENTED_STRING_BUFFER	Allows you to reduce the overhead of I/O operations at run time when you are manipulating a segmented string.
RDMS$DEBUG_FLAGS	Allows you to examine database access strategies and the estimated cost of those strategies when your program runs.
RDMS$SET_FLAGS	Allows you to examine database access strategies and the estimated cost of those strategies when your program runs. See the SET FLAGS Statement for a list of valid keywords that can be used with this logical name.
RDMS$DIAG_FLAGS	When defined to 'L', prevents the opening of a scrollable list cursor when the online format of lists is chained.
RDMS$RTX_SHRMEM_PAGE_CNT	Specifies the size of the shared memory area used to manipulate server site-bound, external routine parameter data and control data.
RDMS$USE_OLD_CONCURRENCY	Allows applications to use the isolation-level behavior that was in effect for V4.1.
RDMS$USE_OLD_SEGMENTED_STRING	When defined to YES, the default online format for lists (segmented strings) is chained.
RDMS$VALIDATE_ROUTINE	Controls the validation of routines.
SQL$DATABASE	Specifies the database that SQL declares if you do not explicitly declare a database.
SQL$DISABLE_CONTEXT	Disables the two-phase commit protocol. Useful for turning off distributed transactions when you want to run batch-update transactions.
SQL$EDIT	Specifies the editor that SQL invokes when you issue the EDIT statement in interactive SQL. See the EDIT Statement for details.
SQLINI	Specifies the command file that SQL executes when you invoke interactive SQL.
SYS$CURRENCY	Specifies the character that SQL substitutes for the dollar sign ($) symbol in an EDIT STRING clause of a column or domain definition, or the EDIT USING clause of a SELECT statement.

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Table E–1 (Cont.) Summary of SQL Logical Names

Logical Name	Function
SYS$DIGIT_SEP	Specifies the character that SQL substitutes for the comma symbol (,) in an EDIT STRING clause of a column or domain definition, or the EDIT USING clause of a SELECT statement.
SYS$LANGUAGE	Specifies the language that SQL uses for date and time input and displays, or the EDIT USING clause of a SELECT statement.
SYS$RADIX_POINT	Specifies the character that SQL substitutes for the decimal point symbol (.) in an EDIT STRING clause of a column or domain definition, or the EDIT USING clause of a SELECT statement.

Table E–2 shows the valid equivalence names for the logical name RDB$CHARACTER_SET.

Table E–2 Valid Equivalence Names for RDB$CHARACTER_SET Logical Name

Character Set	Name of Character Set	Equivalence Name
MCS	DEC_MCS	Undefined
Korean and ASCII	DEC_KOREAN	DEC_HANGUL
Hanyu and ASCII	DEC_HANYU	DEC_HANYU
Hanzi and ASCII	DEC_HANZI	DEC_HANZI
Kanji and ASCII	DEC_KANJI	DEC_KANJI

For more information on these and other logical names, see the *Oracle Rdb7 Guide to Database Performance and Tuning*.

F

Obsolete SQL Syntax

This appendix describes:

- Incompatible syntax

  Certain SQL statements that were allowed in earlier versions of SQL now have different behavior that is incompatible with earlier versions. *You must modify existing applications.*

- Deprecated syntax

  Certain SQL statements that were allowed in earlier versions of SQL will be identified (flagged) with diagnostic messages. SQL refers to such statements as deprecated features. Although these statements will process with expected behavior for this release, SQL may not support them in future versions. You should replace deprecated syntax with the new syntax in applications.

- Reserved words deprecated as identifiers

  If any of the listed reserved words is used as an identifier without double quotation marks ("), SQL flags the usage as being noncompliant with the ANSI/ISO standard and issues a deprecated feature message.

- Punctuation changes

  This section describes changes to punctuation marks used in SQL.

- Suppressing diagnostic messages

  This section describes how to suppress the diagnostic messages about deprecated features.

F.1 Incompatible Syntax

The following sections describe incompatible syntax.

F.1.1 Incompatible Syntax Containing the SCHEMA Keyword

Because one database may contain multiple schemas, the following incompatible changes apply to SQL syntax containing the SCHEMA keyword.

F.1.1.1 CREATE SCHEMA Meaning Incompatible

Use of the CREATE SCHEMA statement to create a database is deprecated. If you use the CREATE SCHEMA statement to specify the physical attributes of a database such as the root file parameters, SQL issues the deprecated feature message and interprets the statement as it did in previous versions of SQL.

```
SQL> CREATE SCHEMA PARTS SNAPSHOT IS ENABLED;
%SQL-I-DEPR_FEATURE, Deprecated Feature: SCHEMA (meaning DATABASE)
SQL>
```

However, if you do not specify any physical attributes of a database, you must enable multischema naming to use the CREATE SCHEMA statement.

```
SQL> CREATE SCHEMA PARTS;
%SQL-F-SCHCATMULTI, Schemas and catalogs may only be referenced with
multischema enabled
```

When you enable multischema naming, the CREATE SCHEMA statement creates a new schema within the current catalog.

```
SQL> ATTACH 'ALIAS Q4 FILENAME INVENTORY MULTISCHEMA IS ON';
SQL> CREATE SCHEMA PARTS;
SQL> SHOW SCHEMAS;
Schemas in database with alias Q4
    RDB$SCHEMA
    PARTS
```

F.1.1.2 SHOW SCHEMA Meaning Incompatible

If you use a SHOW SCHEMA statement when you are attached to a database with the multischema attribute and have multischema naming enabled, SQL shows all the schemas for the current catalog. To show a database, use the SHOW DATABASE or SHOW ALIAS statement.

If you use a SHOW SCHEMA statement when you do not have multischema enabled, SQL issues an error message.

F.1.1.3 DROP SCHEMA Meaning Incompatible

If you use a DROP SCHEMA statement when you are attached to a database with the multischema attribute and have multischema naming enabled, SQL deletes the named schema from that database.

If you use a DROP SCHEMA statement when you do not have multischema enabled, SQL issues an error message.

If you use a DROP SCHEMA FILENAME statement, SQL interprets this as it would have in V4.0 and prior versions; it deletes the database with the named file name, and issues a deprecated feature error message.

F.1.2 DROP TABLE Now Restricts by Default

In V4.1 and higher, the default behavior of the DROP TABLE statement is a restricted delete, not a cascading delete as in earlier versions. Only the table will be deleted. If other items (views, constraints, indexes, or triggers) refer to the specified table, the delete will fail, as shown in the following example:

```
SQL> DROP TABLE DEGREES;
%RDB-E-NO_META_UPDATE, metadata update failed
-RDMS-F-TRGEXI, relation DEGREES is referenced in trigger
COLLEGE_CODE_CASCADE_UPDATE
-RDMS-F-RELNOTDEL, relation DEGREES has not been deleted
```

If you specify the CASCADE keyword for SQL DROP TABLE statements, SQL deletes all items that refer to the table or view, then deletes the table itself. The following example shows a cascading delete:

```
SQL> DROP TABLE JOB_HISTORY CASCADE;
View CURRENT_INFO is also being dropped.
View CURRENT_JOB is also being dropped.
Constraint JOB_HISTORY_FOREIGN1 is also being dropped.
Constraint JOB_HISTORY_FOREIGN2 is also being dropped.
Constraint JOB_HISTORY_FOREIGN3 is also being dropped.
Index JH_EMPLOYEE_ID is also being dropped.
Index JOB_HISTORY_HASH is also being dropped.
VIA clause on storage map JOB_HISTORY_MAP is also being dropped.
Trigger EMPLOYEE_ID_CASCADE_DELETE is also being dropped.
```

F.1.3 Database Handle Names Restricted to 25 Characters

The database handle name is called an alias in SQL. When sessions are enabled by the OPTIONS=(CONNECT) qualifier on the SQL precompiler command line or the CONNECT qualifier on the module language command line, the length of an alias can be no more than 25 characters. The database handle was called an authorization identifier in versions of SQL prior to V4.1.

F.1.4 Deprecated Default Semantics of the ORDER BY Clause

In V4.1 and previous versions, SQL had the following default semantics:

- The ANSI/ISO 1989 standard provides a different direction. In future releases, SQL will assign the sort order of ASC to any key not specifically qualified with DESC.

- SQL will issue a deprecated feature warning if any sort keys inherit the DESC qualifier.

Note

If you do not specify ASC or DESC for the second or subsequent sort keys, SQL uses the order you specified for the preceding sort keys. If you do not specify the sorting order with the first sort key, the default order is ascending.

F.1.5 Change to EXTERNAL NAMES IS Clause

The multischema EXTERNAL NAME IS clause has changed to the STORED NAME IS clause to avoid confusion with ANSI/ISO SQL standards.

F.2 Deprecated Syntax

Table F–1 lists SQL statements that have been replaced by new syntax. These statements will be allowed by SQL, but in some cases SQL flags the statement with a deprecated feature message.

Table F–1 Deprecated Syntax for SQL

Deprecated Statement	New Syntax	Deprecated Feature Message?
ALTER CACHE . . . LARGE MEMORY IS ENABLED	ALTER CACHE ... SHARED MEMORY IS PROCESS RESIDENT	
ALTER CACHE . . . SHARED MEMORY IS SYSTEM	ALTER CACHE . . . SHARED MEMORY IS PROCESS RESIDENT	
ALTER CACHE . . . WINDOW COUNT IS . . .	None	
ALTER SCHEMA	ALTER DATABASE	Yes
CREATE CACHE . . . LARGE MEMORY IS ENABLED	CREATE CACHE . . . SHARED MEMORY IS PROCESS RESIDENT	
CREATE CACHE . . . SHARED MEMORY IS SYSTEM	CREATE CACHE . . . SHARED MEMORY IS PROCESS RESIDENT	
CREATE CACHE . . . WINDOW COUNT IS . . .	None	
CREATE SCHEMA	CREATE DATABASE	Yes[1]

[1]See Section F.1 for more information.

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Table F–1 (Cont.) Deprecated Syntax for SQL

Deprecated Statement	New Syntax	Deprecated Feature Message?
DECLARE SCHEMA — module language and precompiled SQL	DECLARE ALIAS	Yes
DECLARE SCHEMA — dynamic and interactive SQL	ATTACH	In interactive SQL, but not in dynamic SQL
DECLARE and SET TRANSACTION — CONSISTENCY LEVEL 2, 3	ISOLATION LEVEL READ COMMITTED ISOLATION LEVEL REPEATABLE READ ISOLATION LEVEL SERIALIZABLE	Yes
DROP SCHEMA FILENAME	DROP DATABASE FILENAME	Message only in precompiled SQL and SQL module language
DROP SCHEMA PATHNAME	DROP DATABASE PATHNAME	Message only in precompiled SQL and SQL module language
DROP SCHEMA AUTHORIZATION	DROP DATABASE ALIAS	Message only in precompiled SQL and SQL module language
EXPORT SCHEMA FILENAME	EXPORT DATABASE FILENAME	No
EXPORT SCHEMA PATHNAME	EXPORT DATABASE PATHNAME	No
EXPORT SCHEMA AUTHORIZATION	EXPORT DATABASE ALIAS	No
FINISH	DISCONNECT DEFAULT	Yes, if databases are declared with DECLARE SCHEMA; otherwise, error message on nonconforming usage
GRANT on SCHEMA AUTHORIZATION	GRANT ON DATABASE ALIAS	Yes
IMPORT SCHEMA AUTHORIZATION	IMPORT DATABASE FROM filespec WITH ALIAS	Yes
INTEGRATE	INTEGRATE DATABASE	Yes
PREPARE . . . SELECT LIST	DESCRIBE . . . SELECT LIST	Yes
REVOKE	REVOKE ON DATABASE ALIAS	Yes
SET ANSI	SET DEFAULT DATE FORMAT SET KEYWORD RULES SET QUOTING RULES SET VIEW UPDATE RULES	No
ALTER DATABASE . . . JOURNAL IS . . . [NO]CACHE FILENAME . . .	None	Yes. Functionality no longer provides benefit on new hardware

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Table F–1 (Cont.) Deprecated Syntax for SQL

Deprecated Statement	New Syntax	Deprecated Feature Message?
ALTER DATABASE . . . JOURNAL IS . . . NOTIFY	CREATE or ALTER DATABASE NOTIFY	Yes. Feature no longer part of the Alter image journaling functionality.
WRITE ONCE storage area attribute	None	Yes. Functionality is no longer available in hardware
VARIANT	NOT DETERMINISTIC	No. New syntax conforms to SQL:1999 Language Standard
NOT VARIANT	DETERMINISTIC	No. New syntax conforms to SQL:1999 Language Standard
GENERAL PARAMETER STYLE	PARAMETER STYLE GENERAL	No. New syntax conforms to SQL:1999 Language Standard
WHILE . . . LOOP . . . END LOOP	WHILE . . . DO . . . END WHILE	No. New syntax conforms to SQL:1999 Language Standard

F.2.1 Command Line Qualifiers

Certain qualifiers in the SQL module language and precompiler command lines have been replaced. These are:

- The ANSI_AUTHORIZATION qualifier is replaced by the RIGHTS clause.
- The ANSI_DATE qualifier is replaced by the DEFAULT DATE FORMAT clause.
- The ANSI_IDENTIFIERS qualifier is replaced by the KEYWORD RULES clause.
- The ANSI_PARAMETERS qualifier is replaced by the PARAMETER COLONS clause.
- The ANSI_QUOTING qualifier is replaced by the QUOTING RULES clause.

F.2.2 Deprecated Interactive SQL Statements

If you use the SET ANSI statement, SQL returns a deprecated feature message. This statement has been replaced by:

- The SET ANSI DATE statement is replaced by the SET DEFAULT DATE FORMAT statement. See the SET DEFAULT DATE FORMAT Statement for more information.
- The SET ANSI IDENTIFIERS statement is replaced by the SET KEYWORD RULES statement. See the SET KEYWORD RULES Statement for more information.

- The SET ANSI QUOTING statement is replaced by the SET QUOTING RULES statement. See the SET QUOTING RULES Statement for more information.

F.2.3 Constraint Conformance to the ANSI/ISO SQL Standard

The location of the constraint name in the CREATE TABLE statement has been changed for ANSI/ISO SQL conformance. Constraint names are expected before the constraint rather than after. If you place a constraint name after the constraint, you get the following deprecated feature message:

```
SQL> CREATE TABLE TEMP2
cont> (COL1 REAL NOT NULL CONSTRAINT C7);
%SQL-I-DEPR_FEATURE, Deprecated Feature: Constraint name clause following
constraint definition
%SQL-I-DEPR_FEATURE, Deprecated Feature: Default evaluation for constraints:
DEFERRABLE
```

The default evaluation time of DEFERRABLE for constraints has been deprecated. If your dialect is SQLV40, constraints are still DEFERRABLE by default. However, you will receive the following deprecated feature message if you do not specify an evaluation time:

```
SQL> CREATE TABLE TEMP3
cont> (COL1 REAL CONSTRAINT C6 NOT NULL);
%SQL-I-DEPR_FEATURE, Deprecated Feature: Default evaluation for constraints:
DEFERRABLE
```

If your dialect is SQL92 or SQL99, constraints are NOT DEFERRABLE by default, and you do not receive deprecated feature messages.

F.2.4 Obsolete Keywords

Table F–2 lists obsolete keywords and preferred substitutes for SQL statements.

Table F–2 Obsolete SQL Keywords

Obsolete Keyword	Preferred Keyword
COMMIT_TIME	COMMIT TIME
CREATETAB	CREATE
DIAGNOSTIC	CONSTRAINT
QUADWORD	BIGINT

(continued on next page)

Table F–2 (Cont.) Obsolete SQL Keywords

Obsolete Keyword	Preferred Keyword
READ_ONLY	READ ONLY
READ_WRITE	READ WRITE
VERB_TIME	VERB TIME

If you use the obsolete keywords, you receive the following diagnostic message:

```
 SET TRANSACTION READ_ONLY;
                 1
%SQL-I-DEPR_FEATURE, (1) Deprecated Feature: READ_ONLY
```

F.2.5 Obsolete Built-in Functions

Several functions that were supplied as SQL or external routines in the SYS$LIBRARY:SQL_FUNCTIONS library are now obsolete and have been replaced with native SQL builtin functions.

- The function ABS was provided as an SQL function that accepted a DOUBLE PRECISION argument and returned a DOUBLE PRECISION result.

  The native SQL function supports a wider range of of data types (numeric and INTERVAL types) and is more generally useful.

- The functions LEAST and GREATEST were provided as SQL functions that accepted only two integer arguments.

  The native SQL functions allow for a wider range of data types, and support a parameter list of arbitrary length.

- The functions LENGTH and LENGTHB were provided as SQL stored functions that accepted a VARCHAR (2000) parameter and performed the appropriate CHARACTER_LENGTH or OCTET_LENGTH operation on the argument.

  The native SQL functions allow for a wider range of character set values and larger sizes for the character data types.

Now that SQL implements these functions directly these definitions in SYS$LIBRARY:SQL_FUNCTIONS are no longer required. However, they are retained in the database for existing applications but new applications will now automatically use new native functions in Oracle Rdb.

F.3 Deprecated Logical Names

The following sections describe deprecated logical names and, if applicable, the logical name replacement.

See Appendix E for more information regarding any new logical names.

F.3.1 RDB$CHARACTER_SET Logical Name

The logical name RDB$CHARACTER_SET has been deprecated. It is used by SQL to allow compatibility for databases and applications from V4.1 and V4.0.

When you are using versions higher than V4.1 and V4.0, Oracle Rdb recommends that you use the following clauses and statements in place of the logical name:

- The DEFAULT CHARACTER SET and NATIONAL CHARACTER SET clauses in the DECLARE ALIAS statement.
- The IDENTIFIER CHARACTER SET, DEFAULT CHARACTER SET, and NATIONAL CHARACTER SET clauses of the SQL module header (Section 3.2) or the DECLARE MODULE statement.
- The SET IDENTIFIER CHARACTER SET statement, SET DEFAULT CHARACTER SET statement, and the SET NATIONAL CHARACTER SET statement for dynamic SQL.
- The IDENTIFIER CHARACTER SET, DEFAULT CHARACTER SET, and NATIONAL CHARACTER SET clauses in the CREATE DATABASE statement or the ALTER DATABASE statement.

F.4 Reserved Words Deprecated as Identifiers

The following lists contain reserved words from the:

- ANSI/ISO 1989 SQL standard
- ANSI/ISO 1992 SQL standard
- ANSI/ISO 1999 SQL standard

If these reserved words are used as identifiers without double quotation marks ("), SQL flags their use as being noncompliant with the ANSI/ISO 1989 standard and issues a deprecated feature message.

Oracle Rdb does not recommend using reserved words as identifiers because this capability is a deprecated feature and might not be supported in future versions of SQL. However, if you must use reserved words as identifiers, then you must enclose them within double quotation marks to be compliant with the

ANSI/ISO 1989 standard. SQL does not allow lowercase letters, spaces, or tab stops within the double quotation marks.

For example, if you want to use the ANSI/ISO 1989 reserved word SELECT as a table identifier, the statement would be written as follows:

```
SELECT * FROM "SELECT";
```

F.4.1 ANSI/ISO 1989 SQL Standard Reserved Words

ALL	AND	ANY
AS	ASC	AUTHORIZATION
AVG	BEGIN	BETWEEN
BY	CHAR	CHARACTER
CHECK	CLOSE	COBOL
COMMIT	CONTINUE	COUNT
CREATE	CURRENT	CURSOR
DEC	DECIMAL	DECLARE
DEFAULT	DELETE	DESC
DISTINCT	DOUBLE	END
ESCAPE	EXEC	EXISTS
FETCH	FLOAT	FOR
FOREIGN	FORTRAN	FOUND
FROM	GO	GOTO
GRANT	GROUP	HAVING
IN	INDICATOR	INSERT
INT	INTEGER	INTO
IS	KEY	LANGUAGE
LIKE	MAX	MIN
MODULE	NOT	NULL
NUMERIC	OF	ON
OPEN	OPTION	OR
ORDER	PASCAL	PLI
PRECISION	PRIMARY	PRIVILEGES
PROCEDURE	PUBLIC	REAL
REFERENCES	ROLLBACK	SCHEMA

SECTION	SELECT	SET
SMALLINT	SOME	SQL
SQLCODE	SQLERROR	SUM
TABLE	TO	UNION
UNIQUE	UPDATE	USER
VALUES	VIEW	WHENEVER
WHERE	WITH	WORK

F.4.2 ANSI/ISO 1992 SQL Standard Reserved Words

In addition to the reserved words listed for the ANSI/ISO 1989 standard, the ANSI/ISO SQL standard also includes the following reserved words:

ABSOLUTE	ACTION	ADD
ALLOCATE	ALTER	ARE
ASSERTION	AT	BIT
BIT_LENGTH	BOTH	CASCADE
CASCADED	CASE	CAST
CATALOG	CHAR_LENGTH	CHARACTER_LENGTH
COALESCE	COLLATE	COLLATION
COLUMN	CONNECT	CONNECTION
CONSTRAINT	CONSTRAINTS	CONVERT
CORRESPONDING	CROSS	CURRENT_DATE
CURRENT_TIME	CURRENT_TIMESTAMP	CURRENT_USER
DATE	DAY	DEALLOATE
DEFERRABLE	DEFERRED	DESCRIBE
DESCRIPTOR	DIAGNOSTICS	DISCONNECT
DOMAIN	DROP	ELSE
END-EXEC	EXCEPT	EXCEPTION
EXECUTE	EXTERNAL	EXTRACT
FALSE	FIRST	FULL
GET	GLOBAL	HOUR
IDENTITY	IMMEDIATE	INITIALLY
INNER	INPUT	INSENSITIVE
INTERSECT	INTERVAL	ISOLATION

JOIN	LAST	LEADING
LEFT	LEVEL	LOCAL
LOWER	MATCH	MINUTE
MONTH	NAMES	NATIONAL
NATURAL	NCHAR	NEXT
NO	NULLIF	OCTET_LENGTH
ONLY	OUTER	OUTPUT
OVERLAPS	PAD	PARTIAL
POSITION	PREPARE	PRESERVE
PRIOR	READ	RELATIVE
RESTRICT	REVOKE	RIGHT
ROWS	SCROLL	SECOND
SESSION	SESSION_USER	SIZE
SPACE	SQLSTATE	SUBSTRING
SYSTEM_USER	TEMPORARY	THEN
TIME	TIMESTAMP	TIMEZONE_HOUR
TIMEZONE_MINUTE	TRAILING	TRANSACTION
TRANSLATE	TRANSLATION	TRIM
TRUE	UNKNOWN	UPPER
USAGE	USING	VALUE
VARCHAR	VARYING	WHEN
WRITE	YEAR	ZONE

F.4.3 ANSI/ISO 1999 SQL Standard Reserved Words

In addition to the reserved words listed for the ANSI/ISO 1989 standard and the ANSI/ISO SQL 1992 standard, the ANSI/ISO SQL 1999 standard includes the following reserved words.

ADMIN	AFTER	AGGREGATE
ALIAS	ARRAY	BEFORE
BINARY	BLOB	BOOLEAN
BREADTH	CALL	CLASS
CLOB	COMPLETION	CONDITION
CONSTRUCTOR	CUBE	CURRENT_PATH

CURRENT_ROLE	CYCLE	DATA
DEPTH	DEREF	DESTROY
DESTRUCTOR	DETERMINISTIC	DICTIONARY
DO	DYNAMIC	EACH
ELSEIF	EQUALS	EVERY
EXIT	FREE	FUNCTION
GENERAL	GROUPING	HANDLER
HOST	IF	IGNORE
INITIALIZE	INOUT	ITERATE
LARGE	LATERAL	LEAVE
LESS	LIMIT	LIST
LOCALTIME	LOCALTIMESTAMP	LOCATOR
LONG	LOOP	MAP
MODIFIES	MODIFY	NCLOB
NEW	NONE	NUMBER
OBJECT	OFF	OLD
OPERATION	ORDINALITY	OUT
PARAMETER	PARAMETERS	PATH
POSTFIX	PREFIX	PREORDER
RAW	READS	RECURSIVE
REDO	REF	REFERENCING
REPEAT	RESIGNAL	RESULT
RETURN	RETURNS	ROLE
ROLLUP	ROUTINE	ROW
SAVEPOINT	SCOPE	SEARCH
SENSITIVE	SEQUENCE	SETS
SIGNAL	SIMILAR	SPECIFIC
SPECIFICTYPE	SQLEXCEPTION	SQLWARNING
START	STATEMENT	STATIC
STRUCTURE	TERMINATE	THAN

TREAT	TRIGGER	TYPE
UNDER	UNDO	UNNEST
UNTIL	VARIABLE	WHILE
WITHOUT		

F.4.4 Words From ANSI/ISO SQL3 Draft Standard No Longer Reserved

In previous releases, the following words were listed as reserved words according to the ANSI/ISO SQL3 draft standard but did not become part of the final ANSI/ISO 1999 SQL standard. The following words are no longer reserved by Oracle Rdb as previously documented:

ACTOR	ASYNC	ELEMENT
INSTEAD	MOVE	MULTISET
NEW_TABLE	OID	OLD_TABLE
OPERATORS	OTHERS	PENDANT
PRIVATE	PROTECTED	REPRESENTATION
TEMPLATE	TEST	THERE
TUPLE	VARIANT	VIRTUAL
VISIBLE	WAIT	

F.5 Punctuation Changes

The following changes apply to punctuation marks used in SQL.

F.5.1 Single Quotation Marks Required for String Literals

Use single (') instead of double (") quotation marks to delimit a string literal. SQL flags literals enclosed within double quotation marks with an informational, compile-time, diagnostic message stating that this is nonstandard usage. This message will appear even when you have specified that SQL not notify you of syntax that is not ANSI/ISO SQL standard.

F.5.2 Double Quotation Marks Required for ANSI/ISO SQL Delimited Identifiers

The leftmost name pair in a qualified name for a multischema object is a **delimited identifier**. You must enclose a delimited identifier within double quotation marks and use only uppercase characters. You must enable ANSI/ISO SQL quoting rules to use delimited identifiers. For more information, see Section 2.2.11.

F.5.3 Colons Required Before Host Language Variables in SQL Module Language

In SQL module language statements, Oracle Rdb recommends that you precede parameters with a colon (:) to distinguish them from column or table names. These colons are currently optional in SQL, but are required by the ANSI/ISO SQL standard. SQL may require these colons in a future version of Oracle Rdb.

F.6 Suppressing Diagnostic Messages

In interactive SQL, use the SET WARNING NODEPRECATE statement to suppress the diagnostic messages about deprecated features. For more information, see the SET Statement.

If you are using the SQL precompiler, you can suppress the diagnostic messages about deprecated features by using the SQLOPTIONS=WARN=(NODEPRECATE) qualifier in the precompiler command line. For details, see Section 4.3.

If you are using SQL module language, you can suppress the diagnostic messages about deprecated features by using the WARN=(NODEPRECATE) qualifier in the module language command line. For details, see Section 3.6.

G

Oracle RDBMS Compatibility

G.1 Oracle RDBMS Functions

SQL functions have been added to the OpenVMS Oracle Rdb SQL interface for convergence with Oracle SQL. Complete descriptions of these functions can be found in the *Oracle Server SQL Language Reference Manual*.

G.1.1 Built-In Oracle SQL Functions

Table G–1 describes the new functions that are built into the Oracle Rdb SQL interface:

Table G–1 Built-In Oracle SQL Functions

Function Name	Description
ABS (n)	Returns the absolute value of n.

(continued on next page)

Table G–1 (Cont.) Built-In Oracle SQL Functions

Function Name	Description

CONCAT (s1,s2)	Returns s1 concatenated with s2.
	
	CONCAT is functionally equivalent to the concatenation operator (| |) in Oracle Rdb. For example:
	
	`SQL> SELECT DISTINCT`
	`cont>  CONCAT (`
	`cont>  CONCAT (`
	`cont>  CONCAT (e.last_name, 'has a '),`
	`cont>  d.degree),`
	`cont>  ' degree')`
	`cont> FROM employees e, degrees d`
	`cont> WHERE e.employee_id = d.employee_id`
	`cont> LIMIT TO 5 ROWS;`
	
	`Ames has a MA degree`
	`Ames has a PhD degree`
	`Andriola has a MA degree`
	`Andriola has a PhD degree`
	`Babbin has a MA degree`
	`5 rows selected`

CONVERT (str, dest_char_set)	Converts a character string to the specified character set.
	
	You cannot specify the source character set as you can with Oracle. dest_char_set must be a character set supported by Oracle Rdb.
	
	For example:
	
	`SQL> SELECT CONVERT (english, RDB$SHIFT_JIS)`
	`cont> FROM colours;`
	
	`Black`
	`White`
	`Blue`
	`Red`
	`Yellow`
	`Green`
	`6 rows selected`

(continued on next page)

Table G–1 (Cont.) Built-In Oracle SQL Functions

Function Name	Description

DECODE (expr,srch1,res1, [,srch2,res2, . . . ,srchn,resn] [,default])	Compares expr to srch1 through srchn until a match is found. When a match is found, DECODE returns the corresponding result in resn. If no match is found, DECODE returns the default if specified, null if not. For example:
	
	`SQL> SELECT employee_id, last_name, first_name,`
	`cont> DECODE (status_code, '1', 'Full time',`
	`cont>  '2', 'Part time')`
	`cont> FROM employees`
	`cont> LIMIT TO 5 ROWS;`
	` EMPLOYEE_ID  LAST_NAME  FIRST_NAME`
	` 00165  Smith  Terry  Part time`
	` 00190  O'Sullivan  Rick  Full time`
	` 00187  Lasch  Stan  Full time`
	` 00169  Gray  Susan  Full time`
	` 00176  Hastings  Norman  Full time`
	`5 rows selected`

GREATEST (v1,v2)	Returns the greater of v1 or v2.
LEAST (v1,v2)	Returns the lessor of v1 or v2.
LENGTH (str)	Returns the length of str in characters.
LENGTHB (str)	Returns the length of str in bytes.
ROUND (n[,m])	Returns n rounded to m places right of the decimal point. m can be negative to round off digits left of the decimal point. m must be an integer.

SYSDATE	Returns the current date and time. Requires no arguments.
	
	SYSDATE is a synonym for CURRENT_TIMESTAMP. As with CURRENT_TIMESTAMP, the return result of SYSDATE is affected by the setting of the SET DEFAULT DATE FORMAT statement as shown in the following example:
	
	`SQL> SET DEFAULT DATE FORMAT 'SQL99'`
	`SQL> SELECT SYSDATE, CURRENT_TIMESTAMP`
	`cont>  FROM RDB$DATABASE;`
	
	` 1995-08-21 15:21:05.29  1995-08-21 15:21:05.29`
	`1 row selected`
	`SQL> SET DEFAULT DATE FORMAT 'VMS'`
	`SQL> SELECT SYSDATE, CURRENT_TIMESTAMP`
	`cont>  FROM RDB$DATABASE;`
	
	` 21-AUG-1995 15:21:24.83  21-AUG-1995 15:21:24.83`
	`1 row selected`

TRUNC (n[,m])	Returns n truncated to m decimal places. m can be negative to truncate (make zero) m digits to the left of the decimal point.

G.1.2 Optional Oracle SQL Functions

Optionally, you can install the functions listed in Table G–2 in your database from interactive SQL as shown in the following examples.
The file is named SQL_FUNCTIONSnn.SQL, where "nn" is the version number. For example, use the following statement:

```
SQL> ATTACH 'FILENAME mydatabase';
SQL> @SYS$LIBRARY:SQL_FUNCTIONS71.SQL
```

If you wish to use a character set other than DEC_MCS with the installable functions, you must first define the RDB$ORACLE_SQLFUNC_VCHAR_DOM domain as a character type using the desired character set before executing the preceding statements. Similarly, if you wish to use a date data type other than DATE VMS with the installable functions, you must first define the RDB$ORACLE_SQLFUNC_DATE_DOM domain as a date data type before executing the preceding statements.

For example,

```
SQL> ATTACH 'FILENAME mydatabase';
SQL> CREATE DOMAIN RDB$ORACLE_SQLFUNC_VCHAR_DOM VARCHAR(2000)
cont> CHARACTER SET KANJI;
SQL> CREATE DOMAIN RDB$ORACLE_SQLFUNC_DATE_DOM DATE ANSI;
SQL> @SYS$LIBRARY:SQL_FUNCTIONS71.SQL
```

If you choose, you may remove the installable functions from your database at a later time. However, you must release any dynamic SQL statements and disconnect any sessions that reference any of these functions before you can remove the functions. Use the following statements from interactive SQL if you wish to remove the installable functions from your database:

```
SQL> ATTACH 'FILENAME mydatabase';
SQL> @SYS$LIBRARY:SQL_FUNCTIONS_DROP71.SQL
```

The file SYS$LIBRARY:SQL_FUNCTIONS_DROPnn.SQL, where "nn" is the version number.

Table G–2 gives a brief description of each of the functions that you can optionally install in your database.

Table G–2 Optional Oracle SQL Functions

Function Name	Description	Restrictions
ADD_MONTHS (d,n)	Returns the date d plus n months.	d must be of the same date data type as the RDB$ORACLE_ SQLFUNC_DATE_DOM domain, which is bound when you install the Oracle SQL functions.
ASCII (str)	Returns the decimal representation of the first character of its argument.	str must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions.
CEIL (n)	Returns the smallest integer greater than or equal to n.	
CHR (n)	Returns the character having the binary equivalent to n.	The returned value is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM, the character set of which is bound when you install the Oracle SQL functions. In addition, only 1 octet (byte) of data is encoded.
COS (n)	Returns the cosine of n (an angle expressed in radians).	
COSH (n)	Returns the hyperbolic cosine of n (an angle expressed in radians).	
EXP (n)	Returns e raised to the nth power (e=2.71828183 . . .).	
FLOOR (n)	Returns the largest integer equal to or less than n.	

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
HEXTORAW (str)	Converts its argument containing hexadecimal digits to a raw character value.	str must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM.
INITCAP (str)	Returns the string argument, with the first letter of each word in uppercase, all other letters in lowercase. Words are delimited by non-alphanumeric characters.	str must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM.
INSTR (s1,s2[,n[,m]])	Searches s1 beginning with its nth character and returns the character position of the mth occurrence of s2 or 0 if s2 does not occur m times. If n < 0, the search starts at the end of s1.	s1 and s2 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. If either n or m is omitted, they default to 1.

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
INSTRB (s1,s2[,n[,m]])	Searches s1 beginning with its nth octet and returns the octet position of the mth occurrence of s2 or 0 if s2 does not occur m times. If n < 0, the search starts at the end of s1.	s1 and s2 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. If either n or m is omitted, they default to 1.
LAST_DAY (d)	Returns the last day of the month that contains d.	d must be of the same date data type as the RDB$ORACLE_ SQLFUNC_DATE_DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_DATE_DOM.
LN (n)	Returns the natural logarithm of n where n is greater than 0.	
LOG (m,n)	Returns the logarithm base m of n. The base m can be any positive number other than 0 or 1 and n can be any positive number.	
LPAD (s,l,p)	Returns s left-padded to length l with the sequence of characters in p. If s is longer than l, this function returns that portion of s that fits in l.	s and p must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. There is no default for p as with Oracle.

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
LTRIM (s1[,s2])	Removes characters from the left of s1, with initial characters removed up to the first character not in s2.	s1 and s2 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted,s2 defaults to space.
MOD (m,n)	Returns the remainder of m divided by n. Returns m if n is 0.	
MONTHS_BETWEEN (d1,d2)	Returns the number of months between dates d1 and d2.	d1 and d2 must be of the same date data type as the RDB$ORACLE_ SQLFUNC_DATE_DOM domain, which is bound when you install the Oracle SQL functions.
NEW_TIME (d1,z1,z2)	Returns the date and time in time zone z2 when the date and time in time zone z1 is d. Time zones z1 and z2 can be: AST, ADT, BST, BDT, CST, CDT, EST, EDT, GMT, HST, HDT, MST, MDT, NST, PST, PDT, YST, or YDT.	d1 must be of the same date data type as the RDB$ORACLE_ SQLFUNC_DATE_DOM domain, which is bound when you install the Oracle SQL functions. z1 and z2 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_DATE_DOM.

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
NEXT_DAY (d,dayname)	Returns the date of the first weekday named by dayname that is later than the date d.	d must be of the same date data type as the RDB$ORACLE_ SQLFUNC_DATE_DOM domain, which is bound when you install the Oracle SQL functions. dayname must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_DATE_DOM.
POWER (m,n)	Returns m raised to the nth power. The base m and the exponent n can be any number but if m is negative, n must be an integer.	
RAWTOHEX (str)	Converts its raw argument to a character value containing its hexadecimal equivalent.	str must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM.

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
REPLACE (s1[,s2[,s3]])	Returns s1 with every occurrence of s2 replaced by s3.	s1, s2, and s3 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted, s2 and s3 default to an empty string.
RPAD (s[,l[,p]])	Returns s left-padded to length l with the sequence of characters in p. If s is longer than l, this function returns that portion of s that fits in l.	s and p must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted, p defaults to a space.
RTRIM (s1[,s2])	Returns s2 with final characters after the last character not in s2.	s1 and s2 must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted, s2 defaults to a space.

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
SIGN (n)	If n < 0, the function returns -1. If n = 0, the function returns 0. If n > 0, the function returns 1.	
SIN (n)	Returns the sine of n (an angle expressed in radians).	
SINH (n)	Returns the hyperbolic sine of n (an angle expressed in radians).	
SQRT (n)	Returns the square root of n. The value of n cannot be negative. SQRT returns a double precision result.	
SUBSTR (s[,p[,l]])	Returns a portion of s, l characters long, beginning at character position p. If p is negative, SUBSTR counts backward from the end of s.	s must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted, l defaults to zero (0).
SUBSTRB (s[,p[,l]])	Same as SUBSTR, except p and l are expressed in octets (bytes) rather than characters.	s must be of the same character set as the RDB$ORACLE_ SQLFUNC_VCHAR_ DOM domain, which is also bound when you install the Oracle SQL functions. The value returned is of type RDB$ORACLE_ SQLFUNC_VCHAR_ DOM. If omitted, l defaults to zero (0).

(continued on next page)

Table G–2 (Cont.) Optional Oracle SQL Functions

Function Name	Description	Restrictions
TAN (n)	Returns the tangent of n (an angle expressed in radians).	
TANH (n)	Returns the hyperbolic tangent of n (an angle expressed in radians).	

G.2 Oracle Style Outer Join

Oracle Rdb supports the SQL Database Language Standard syntax for performing outer join between two or more tables, namely the LEFT, RIGHT, and FULL OUTER JOIN clauses. Oracle Rdb also supports alternative syntax and semantics that conform to those available in Oracle RDMS SQL language to enhance the compatibility between these two products. The special operator (+) can be placed in the WHERE clause to instruct SQL to join tables using outer join semantics.

An outer join extends the result of a simple join. An outer join returns all rows that satisfy the join condition and those rows from one table for which no rows from the other satisfy the join condition. Such rows are not returned by a simple join. To write a query that performs an outer join of tables A and B and returns all rows from A, apply the outer join operator (+) to all columns of B in the join condition. For all rows in A that have no matching rows in B, Oracle Rdb returns NULL for any select list expressions containing columns of B.

Outer join queries are subject to the following rules and restrictions:

- The (+) operator can appear only in the WHERE clause and can be applied only to a column of a table or view.
- If A and B are joined by multiple join conditions, you must use the (+) operator in all of these conditions. If you do not, Oracle Rdb will return only the rows resulting from a simple join, but without a warning or error to advise you that you do not have the results of an outer join.
- The (+) operator can be applied only to a column, not to an arbitrary expression. However, an arbitrary expression can contain a column marked with the (+) operator.
- A condition containing the (+) operator cannot be combined with another condition using the OR logical operator.

- A condition cannot use the IN comparison operator to compare a column marked with the (+) operator with an expression.
- A condition cannot compare any column marked with the (+) operator with a subquery.

If the WHERE clause contains a condition that compares a column from table B with a constant, the (+) operator must be applied to the column so that Oracle Rdb returns the rows from table A for which it has generated NULLs for this column. Otherwise Oracle Rdb will return only the results of a simple join.

In a query that performs outer joins of more than two pairs of tables, a single table can be the NULL-generated table for only one other table. For this reason, you cannot apply the (+) operator to columns of B in the join condition for A and B and the join condition for B and C.

G.2.1 Outer Join Examples

The examples in this section extend the results of this inner join (Equijoin) between EMP and DEPT tables.

```
SQL> SELECT ename, job, dept.deptno, dname
cont>  FROM emp, dept
cont>  WHERE emp.deptno = dept.deptno;
 EMP.ENAME    EMP.JOB      DEPT.DEPTNO   DEPT.DNAME
 King         President             10   Accounting
 Blake        Manager               30   Sales
 Clark        Manager               10   Accounting
 Jones        Manager               20   Research
 Ford         Analyst               20   Research
 Smith        Clerk                 20   Research
 Allen        Salesman              30   Sales
 Ward         Salesman              30   Sales
 Martin       Salesman              30   Sales
 Scott        Analyst               20   Research
 Turner       Salesman              30   Sales
 Adams        Clerk                 20   Research
 James        Clerk                 30   Sales
 Miller       Clerk                 10   Accounting
14 rows selected
```

The following query uses an outer join to extend the results of this Equijoin example above:

```
SQL> SELECT ename, job, dept.deptno, dname
cont>  FROM emp, dept
cont>  WHERE emp.deptno (+) = dept.deptno;
 EMP.ENAME    EMP.JOB      DEPT.DEPTNO   DEPT.DNAME
 King         President             10   Accounting
 Clark        Manager               10   Accounting
 Miller       Clerk                 10   Accounting
 Jones        Manager               20   Research
 Ford         Analyst               20   Research
 Smith        Clerk                 20   Research
 Scott        Analyst               20   Research
 Adams        Clerk                 20   Research
 Blake        Manager               30   Sales
 Allen        Salesman              30   Sales
 Ward         Salesman              30   Sales
 Martin       Salesman              30   Sales
 Turner       Salesman              30   Sales
 James        Clerk                 30   Sales
 NULL         NULL                  40   Operations
15 rows selected
```

In this outer join, Oracle Rdb returns a row containing the OPERATIONS department even though no employees work in this department. Oracle Rdb returns NULL in the ENAME and JOB columns for this row. The join query in this example selects only departments that have employees.

The following query uses an outer join to extend the results of the preceding example:

```
SQL> SELECT ename, job, dept.deptno, dname
cont>  FROM emp, dept
cont>  WHERE emp.deptno (+) = dept.deptno
cont>     AND job (+) = 'Clerk';
 EMP.ENAME    EMP.JOB      DEPT.DEPTNO   DEPT.DNAME
 Miller       Clerk                 10   Accounting
 Smith        Clerk                 20   Research
 Adams        Clerk                 20   Research
 James        Clerk                 30   Sales
 NULL         NULL                  40   Operations
5 rows selected
```

In this outer join, Oracle Rdb returns a row containing the OPERATIONS department even though no clerks work in this department. The (+) operator on the JOB column ensures that rows for which the JOB column is NULL are also returned. If this (+) were omitted, the row containing the OPERATIONS department would not be returned because its JOB value is not 'CLERK'.

```
SQL> SELECT ename, job, dept.deptno, dname
cont>  FROM emp, dept
cont>  WHERE emp.deptno (+) = dept.deptno
cont>     AND job = 'Clerk';
 EMP.ENAME    EMP.JOB      DEPT.DEPTNO   DEPT.DNAME
 Miller       Clerk                 10   Accounting
 Smith        Clerk                 20   Research
 Adams        Clerk                 20   Research
 James        Clerk                 30   Sales
4 rows selected
```

This example shows four outer join queries on the CUSTOMERS, ORDERS, LINEITEMS, and PARTS tables. These tables are shown here:

```
SQL> SELECT custno, custname
cont>  FROM customers
cont>  ORDER BY custno;
      CUSTNO   CUSTNAME
           1   Angelic Co
           2   Believable Co
           3   Cables R Us
3 rows selected
SQL>
SQL> SELECT orderno, custno, orderdate
cont>  FROM orders
cont>  ORDER BY orderno;
     ORDERNO        CUSTNO   ORDERDATE
        9001             1   1999-10-13
        9002             2   1999-10-13
        9003             1   1999-10-20
        9004             1   1999-10-27
        9005             2   1999-10-31
5 rows selected
SQL>
SQL> SELECT orderno, lineno, partno, quantity
cont>  FROM lineitems
cont>  ORDER BY orderno, lineno;
     ORDERNO        LINENO        PARTNO      QUANTITY
        9001             1           101            15
        9001             2           102            10
        9002             1           101            25
        9002             2           103            50
        9003             1           101            15
        9004             1           102            10
        9004             2           103            20
7 rows selected
SQL>
SQL> SELECT partno, partname
cont>  FROM parts
cont>  ORDER BY partno;
      PARTNO   PARTNAME
         101   X-Ray Screen
```

```
         102   Yellow Bag
         103   Zoot Suit
3 rows selected
```

The customer Cables R Us has placed no orders, and order number 9005 has no line items.

The following outer join returns all customers and the dates they placed orders. The (+) operator ensures that customers who placed no orders are also returned:

```
SQL> SELECT custname, orderdate
cont>  FROM customers, orders
cont>  WHERE customers.custno = orders.custno (+)
cont>  ORDER BY customers.custno, orders.orderdate;
 CUSTOMERS.CUSTNAME   ORDERS.ORDERDATE
 Angelic Co           1999-10-13
 Angelic Co           1999-10-20
 Angelic Co           1999-10-27
 Believable Co        1999-10-13
 Believable Co        1999-10-31
 Cables R Us          NULL
6 rows selected
```

The following outer join builds on the result of the previous one by adding the LINEITEMS table to the FROM clause, columns from this table to the select list, and a join condition joining this table to the ORDERS table to the where_ clause. This query joins the results of the previous query to the LINEITEMS table and returns all customers, the dates they placed orders, and the part number and quantity of each part they ordered. The first (+) operator serves the same purpose as in the previous query. The second (+) operator ensures that orders with no line items are also returned:

```
SQL> SELECT custname, orderdate, partno, quantity
cont>  FROM customers, orders, lineitems
cont>  WHERE customers.custno = orders.custno (+)
cont>     AND orders.orderno = lineitems.orderno (+)
cont>  ORDER BY customers.custno, orders.orderdate, lineitems.partno;
 CUSTOMERS.CUSTNAME  ORDERS.ORDERDATE  LINEITEMS.PARTNO  LINEITEMS.QUANTITY
 Angelic Co          1999-10-13                    101                  15
 Angelic Co          1999-10-13                    102                  10
 Angelic Co          1999-10-20                    101                  15
 Angelic Co          1999-10-27                    102                  10
 Angelic Co          1999-10-27                    103                  20
 Believable Co       1999-10-13                    101                  25
 Believable Co       1999-10-13                    103                  50
 Believable Co       1999-10-31                   NULL                NULL
 Cables R Us         NULL                         NULL                NULL
9 rows selected
```

The following outer join builds on the result of the previous one by adding the PARTS table to the FROM clause, the PARTNAME column from this table to the select list, and a join condition joining this table to the LINEITEMS table to the where_clause. This query joins the results of the previous query to the PARTS table to return all customers, the dates they placed orders, and the quantity and name of each part they ordered. The first two (+) operators serve the same purposes as in the previous query. The third (+) operator ensures that rows with NULL part numbers are also returned:

```
SQL> SELECT custname, orderdate, quantity, partname
cont>  FROM customers, orders, lineitems, parts
cont>  WHERE customers.custno = orders.custno (+)
cont>     AND orders.orderno = lineitems.orderno (+)
cont>     AND lineitems.partno = parts.partno (+)
cont>  ORDER BY customers.custno, orders.orderdate, parts.partno;
 CUSTOMERS.CUSTNAME   ORDERS.ORDERDATE   LINEITEMS.QUANTITY   PARTS.PARTNAME
 Angelic Co           1999-10-13                       15   X-Ray Screen
 Angelic Co           1999-10-13                       10   Yellow Bag
 Angelic Co           1999-10-20                       15   X-Ray Screen
 Angelic Co           1999-10-27                       10   Yellow Bag
 Angelic Co           1999-10-27                       20   Zoot Suit
 Believable Co        1999-10-13                       25   X-Ray Screen
 Believable Co        1999-10-13                       50   Zoot Suit
 Believable Co        1999-10-31                     NULL   NULL
 Cables R Us          NULL                           NULL   NULL
9 rows selected
```

G.2.2 Oracle Server Predicate

The following notes apply when you use the Oracle server predicate:

- If tables A and B are joined by multiple join conditions, then the plus (+) operator must be used in all these conditions.
- The plus operator can be applied only to a column, not to an arbitrary expression. However, an arbitrary expression can contain a column marked with the plus operator.
- A condition containing the plus operator cannot be combined with another condition using the OR logical operator.
- A condition cannot use the IN comparison operator to compare a column marked with the plus operator to another expression.
- A condition cannot compare a column marked with the plus operator to a subquery.

- If the WHERE clause contains a condition that compares a column from table B to a constant, then the plus operator must be applied to the column such that the rows from table A for which Oracle Rdb has generated NULLs for this column are returned.
- In a query that performs outer joins of more than two pairs of tables, a single table can only be the null-generated table for one other table. For this reason, you cannot apply the plus operator to the column of table B in the join condition for tables A and B and the join condition for tables B and C.

H
Information Tables

H.1 Introduction to Information Tables

Information tables display internal information about storage areas, after-image journals, row caches, database users, the database root, and database character sets. Once the information tables are created, you can query them with the SQL interface.

Information tables are special read-only tables that can be created in an Oracle Rdb Release 7.1 database and used to retrieve database attributes that are not stored in the existing relational tables. Information tables allow interesting database information, which is currently stored in an internal format, to be displayed as a relational table.

The script, INFO_TABLES.SQL, is supplied as a part of the Oracle Rdb kit. The INFO_TABLES.SQL file is in the SQL$SAMPLE directory. Table H–1 lists the information tables that are supported in Oracle Rdb Release 7.1.

Table H–1 Supported Information Tables

Table Name	Description
RDB$STORAGE_AREAS	Displays information about the database storage areas.
RDB$DATABASE_JOURNAL	Displays information about the default journal.
RDB$CACHES	Displays information about the database row caches.
RDB$DATABASE_ROOT	Displays information about the database root.
RDB$JOURNALS	Displays information about the database journal files.
RDB$DATABASE_USERS	Displays information about the database users.
RDB$LOGICAL_AREAS	Displays information about the logical areas.
RDB$CHARACTER_SETS	Displays information about the Oracle Rdb character sets.
RDB$NLS_CHARACTER_SETS	Displays the mapping of Oracle NLS character sets to Oracle Rdb character sets.

For additional information about these information tables on OpenVMS, see the ORACLE_RDBnn topic and select the Information_Tables subtopic (where nn is the version number if using multiversion) in the Oracle Rdb command-line Help.

Examples

Example 1: Querying an information tables

The following example shows how to query one of the information tables created by the INFO_TABLES.SQL script.

```
SQL> SELECT * FROM RDB$LOGICAL_AREAS WHERE RDB$LOGICAL_AREA_NAME='JOBS';
 RDB$LOGICAL_AREA_ID   RDB$AREA_ID   RDB$RECORD_LENGTH   RDB$THRESHOLD1_PERCENT
   RDB$THRESHOLD2_PERCENT   RDB$THRESHOLD3_PERCENT   RDB$ORDERED_HASH_OFFSET
      RDB$RECORD_TYPE   RDB$LOGICAL_AREA_NAME
                  95             7                  41                        0
                       0                       0                         0
                     1   JOBS

1 row selected
```

Example 2: Queries to detect growth of storage area files

The database administrator can list storage areas where the current allocation of an area has exceeded the initial allocation. This information can be vital when managing performance in mixed areas. With mixed areas every storage area extension causes extra I/O for HASHED index access.

```
SQL> select RDB$AREA_NAME as NAME edit using 'T(15)',
cont> RDB$INITIAL_ALLOCATION as INITIAL edit using 'Z(9)',
cont> RDB$CURRENT_ALLOCATION as CURRENT edit using 'Z(9)',
cont> RDB$EXTEND_COUNT as EXTENDS edit using 'Z(9)',
cont> RDB$LAST_EXTEND as LAST_EXT_DATE
cont> from RDB$STORAGE_AREAS
cont> where (RDB$CURRENT_ALLOCATION > RDB$INITIAL_ALLOCATION + 1)
cont>   and (RDB$AREA_NAME <> ' ');
 NAME               INITIAL     CURRENT     EXTENDS   LAST_EXT_DATE
 RDB$SYSTEM             102        3724          15   14-AUG-2003 13:53:36.81
 SALARY_HISTORY         270        1270           1    6-AUG-2003 11:47:11.00
2 rows selected
```

This query shows that the system area has extended by almost 37 percent since the database was created. Why is that? Are developers creating tables without mapping the data to user defined storage areas? Area SALARY_HISTORY is a mixed area that has extended. The initial allocation is no longer adequate for this area. Was there a period in August where a lot of data was inserted into these areas? The database administrator can schedule maintenance time to resize the SALARY_HISTORY storage area.

Note

The query adds one to the initial allocation to eliminate areas where a spam page has been added and the current allocation is the initial allocation plus one block. The comparison of RDB$AREA_NAME to a blank space eliminates snapshot areas from the query.

A similar query that shows snapshot files that have grown beyond the initial allocation is:

```
SQL> select RDB$AREA_FILE as SNAP_NAME edit using 'T(50)',
cont> RDB$INITIAL_ALLOCATION as INITIAL edit using 'Z(9)',
cont> RDB$CURRENT_ALLOCATION as CURRENT edit using 'Z(9)'
cont> from RDB$STORAGE_AREAS
cont> where (RDB$CURRENT_ALLOCATION > RDB$INITIAL_ALLOCATION)
cont>   and (RDB$AREA_NAME = ' ');
 SNAP_NAME                                              INITIAL     CURRENT
 DKD300:[SQLUSER71]MF_PERS_DEFAULT.SNP;1                     50        1623
 DKD300:[SQLUSER71]DEPARTMENTS.SNP;1                         10        5000
2 rows selected
```

Large snapshot files are mainly caused by old active transactions, or an initial allocation size that was too small. This query gives the database administrator pointer to an area that needs investigation. Queries such as these can be executed at regular intervals to detect growth trends.

Example 3: Comparing table cardinality with cache sizes

Queries can be run periodically to check that the allocated cache sizes are adequate for the current table size. Know that a cache was too small for the table and taking corrective action can reduce cache collisions.

```
SQL> select A.RDB$CACHE_NAME, A.RDB$CACHE_SIZE, B.RDB$CARDINALITY
cont> from RDB$CACHES A, RDB$RELATIONS B
cont> where A.RDB$CACHE_NAME = B.RDB$RELATION_NAME;
 A.RDB$CACHE_NAME                  A.RDB$CACHE_SIZE      B.RDB$CARDINALITY
 EMPLOYEES                                      100                    103
 DEPARTMENTS                                     26                     26
 DEGREES                                         20                    165
 TOO_BIG                                        500                  10000
 TOO_SMALL                                     1000                    100
5 rows selected
```

In this example the tables TOO_BIG and DEGREES can only cache 5 percent and 12 percent respectively of the total table. Perhaps the cache size needs to be increased? Conversely, table TOO_SMALL appears to have a cache far too large. Maybe this cache was incorrectly configured or the table has shrunk over time? The current cache size is probably wasting memory.

Example 4: Converting logical DBKEY areas to names

Tools such as RMU Verify or RMU Show Statistics often display a logical area DBKEY. For example consider this output from a stall message screen in RMU Show Statictics:

```
202003A5:5  16:25:18.51  waiting for record 79:155:6
```

The database administrator can use RMU /DUMP/LAREA=RDB$AIP to get a list of all the logical areas and their area numbers. However, the following simple query on the RDB$LOGICAL_AREAS information table can be used instead.

```
SQL> select rdb$logical_area_id, rdb$area_id, rdb$logical_area_name
cont> from rdb$logical_areas
cont> where rdb$logical_area_id=79;
 RDB$LOGICAL_AREA_ID   RDB$AREA_ID   RDB$LOGICAL_AREA_NAME
                  79             3   EMPLOYEES
1 row selected
```

The query shows that this stall is on table EMPLOYEES and it resides in physical area number 3. The database administrator can use this information to dump the database page.

```
$ RMU/DUMP/AREA=3/START=155/END=155/OUTPUT=t.t mf_personnel
```

H.2 Restrictions for Information Tables

The following restrictions apply to information tables:

- You cannot alter the information tables. The table names and column names must remain unchanged.
- Documentation on what each bit in the flag fields represents is available on OpenVMS. See the ORACLE_RDBnn topic and select the Information_ Tables subtopic (where nn is the version number if using multiversion) in the Oracle Rdb command-line Help.

I

System Tables

This appendix describes the Oracle Rdb system tables.

Oracle Rdb stores information about the database as a set of special system tables. The system tables are the definitive source of Oracle Rdb metadata. **Metadata** defines the structure of the database; for example, metadata defines the fields that comprise a particular table and the fields that can index that table.

The definitions of most system tables are standard and are likely to remain constant in future versions of Oracle Rdb.

In each description for a particular system table, BLR refers to binary language representation. This is low-level syntax used internally to represent Oracle Rdb data manipulation operations.

The following sections describe the usage of system tables with respect to particular versions of Oracle Rdb or in relation to other database constructs, operations, or products.

I.1 Using Data Dictionary

Although you can store your data definitions in the data dictionary, the database system refers only to the system tables in the database file itself for these definitions. In a sense, the system tables are an internal data dictionary for the database. This method improves performance as Oracle Rdb does not have to access the data dictionary at run time.

I.2 Modifying System Tables

When you create a database, Oracle Rdb defines, populates, and manipulates the system tables. As the user performs data definition operations on the database, Oracle Rdb reads and modifies the system tables to reflect those operations. You should not modify any of the Oracle Rdb system tables using data manipulation language, nor should you define any domains based on system table fields. However, you can use regular Oracle Rdb data manipulation statements to retrieve the contents of the system tables. This

means that your program can determine the structure and characteristics of the database by retrieving the fields of the system tables.

I.3 Updating Metadata

When you use the SQL SET TRANSACTION . . . RESERVING statement to lock a set of tables for an Oracle Rdb operation, you normally exclude from the transaction all the tables not listed in the RESERVING clause. However, Oracle Rdb accesses and updates system tables as necessary, no matter which tables you have locked with the SQL SET TRANSACTION statement.

When your transaction updates database metadata, Oracle Rdb reserves the system tables involved in the update in the EXCLUSIVE share mode. Other users are unable to perform data definition operations on these tables until you complete your transaction. For example:

- When you refer to a domain (global field) in an update transaction that changes data definitions, Oracle Rdb locks an index for the system table, RDB$RELATION_FIELDS. No other users can refer to the same domain until you commit your transaction.
- When you change a relation (table) or domain definition, Oracle Rdb locks an index in the system table, RDB$FIELD_VERSIONS. No other users can change table or global field definitions until you commit your transaction.
- When you change a table definition, Oracle Rdb locks an index in the system table, RDB$RELATION_FIELDS. No other users can change tables in the same index node until you commit your transaction.

I.4 LIST OF BYTE VARYING Metadata

Oracle Rdb has supported multiple segment LIST OF BYTE VARYING data types for user-defined data. However in previous versions, Oracle Rdb maintained its own LIST OF BYTE VARYING metadata columns as single segments. This restricted the length to approximately 65530 bytes. An SQL CREATE TRIGGER or CREATE MODULE statement could fail due to this restriction.

This limit was lifted by changing the way Oracle Rdb stores its own metadata.

- For columns containing binary data, such as the binary representation of query, routine, constraint, trigger action, computed by column, or query outline, Oracle Rdb breaks the data into pieces that best fit the system storage area page size. Thus, the segments are all the same size with a possible small trailing segment.

The LIST OF BYTE VARYING column value is no longer fragmented, improving performance when reading system metadata.

- For columns containing text data such as the SQL source (for elements such as triggers and views) and user-supplied comment strings, Oracle Rdb breaks the text at line boundaries (indicated by ASCII carriage returns and line feeds) and stores the text without the line separator. Thus, the segments are of varying size with a possible zero length for blank lines.

  An application can now easily display the LIST OF BYTE VARYING column value and the application no longer needs to break up the single text segment for printing.

No change is made to the LIST OF BYTE VARYING column values when a database is converted (using the RMU Convert command, RMU Restore command, or SQL EXPORT/IMPORT statements) from a previous version.

Applications that read the Oracle Rdb system LIST OF BYTE VARYING column values must be changed to understand multiple segments. Applications that do not read these system column values should see no change to previous behavior. Tools such as the RMU Extract command and the SQL SHOW and EXPORT statements handle both the old and new formats of the system metadata.

I.5 Read Only Access

The following is a list of fields of various system tables that are set to read-only access.

- RDB$ACCESS_CONTROL
- RDB$FLAGS
- RDB$MODULE_OWNER
- RDB$ROUTINE_OWNER

The following BASIC program uses an SQL Module to query system tables

```
PROGRAM SYSTEM_RELATION
!  This BASIC program interactively prompts a user to enter a name
!  of a system table (table).  Next, the program calls an SQL
!  Module which uses a cursor to read the system table that the
!  user entered.  Upon reading the fields (domains) of the system
!  table, the program displays a message to the user as to whether
!  the fields in a system table can be updated.
OPTION TYPE = EXPLICIT, SIZE = INTEGER LONG
ON ERROR GOTO ERR_ROUTINE
!
! Declare variables and constants
!
DECLARE STRING Column_name, Table_name
DECLARE INTEGER Update_yes, sqlcode
DECLARE INTEGER CONSTANT TRIM_BLANKS = 128, UPPER_CASE = 32
EXTERNAL SUB SET_TRANSACTION (LONG)
EXTERNAL SUB OPEN_CURSOR(LONG,STRING)
EXTERNAL SUB FETCH_COLUMN(LONG,STRING,INTEGER)
EXTERNAL SUB CLOSE_CURSOR(LONG)
EXTERNAL SUB COMMIT_TRANS (LONG)
!
! Prompt for table name
!
INPUT 'Name of Table'; Table_name
Table_name = EDIT$(Table_name, UPPER_CASE)
PRINT 'Starting query'
PRINT 'In '; Table_name; ' Table, columns:'
!
! Call the SQL module to start the transaction.
!
CALL SET_TRANSACTION(Sqlcode)
!
! Open the cursor.
!
CALL OPEN_CURSOR(Sqlcode, Table_name)
GET_LOOP:
WHILE (Sqlcode = 0)
!
! Fetch each column
!
CALL FETCH_COLUMN(Sqlcode, Column_name, Update_yes)
     IF (Sqlcode = 0)
       THEN
         !
         ! Display returned column
         !
         PRINT '  '; EDIT$(Column_name, TRIM_BLANKS);
         IF (update_yes = 1)
           THEN
             PRINT ' can be updated'
           ELSE
             PRINT ' cannot be updated'
```

```
        END IF
     END IF
NEXT

ERR_ROUTINE:
  IF Sqlcode = 100
    THEN
      PRINT "No more rows."
      RESUME PROG_END
    ELSE
      PRINT "Unexpected error: ", Sqlcode, Err
      RESUME PROG_END
  END IF
PROG_END:
!
! Close the cursor, commit work and exit
!
 CALL CLOSE_CURSOR(Sqlcode)
 CALL COMMIT_TRANS(Sqlcode)
END PROGRAM
```

The following module provides the SQL procedures that are called by the preceding BASIC program.

```
-- This SQL module provides the SQL procedures that are called by the
-- preceding BASIC program, system table

-----------------------------------------------------------------
-- Header Information Section
-----------------------------------------------------------------
MODULE          SQL_SYSTEM_REL_BAS  -- Module name
LANGUAGE        BASIC               -- Language of calling program
AUTHORIZATION   SQL_SAMPLE          -- Authorization ID

-----------------------------------------------------------------
-- DECLARE Statements Section
-----------------------------------------------------------------
DECLARE ALIAS FILENAME 'MF_PERSONNEL'  -- Declaration of the database.

DECLARE SELECT_UPDATE CURSOR FOR
    SELECT RDB$FIELD_NAME, RDB$UPDATE_FLAG
    FROM RDB$RELATION_FIELDS
    WHERE RDB$RELATION_NAME = table_name
    ORDER BY RDB$FIELD_POSITION

-----------------------------------------------------------------
-- Procedure Section
-----------------------------------------------------------------
-- Start a transaction.
PROCEDURE SET_TRANSACTION
    SQLCODE;
```

```
    SET TRANSACTION READ WRITE;

-- Open the cursor.
PROCEDURE OPEN_CURSOR
    SQLCODE
    table_name          RDB$RELATION_NAME;

    OPEN SELECT_UPDATE;

-- Fetch a row.
PROCEDURE FETCH_COLUMN
    SQLCODE
    field_name          RDB$FIELD_NAME
    update_flag         RDB$UPDATE_FLAG;

    FETCH SELECT_UPDATE INTO :field_name, :update_flag;

-- Close the cursor.
PROCEDURE CLOSE_CURSOR
    SQLCODE;

    CLOSE SELECT_UPDATE;

-- Commit the transaction.
PROCEDURE COMMIT_TRANS
    SQLCODE;

    COMMIT;
```

I.6 All System Tables

The Oracle Rdb system tables are as follows:

RDB$CATALOG_SCHEMA	Contains the name and definition of each SQL catalog and schema. This table is present only in databases with the SQL multischema feature enabled.
RDB$COLLATIONS	The collating sequences used by this database.
RDB$CONSTRAINTS	Name and definition of each constraint.
RDB$CONSTRAINT_RELATIONS	Name of each table that participates in a given constraint.
RDB$DATABASE	Database-specific information.
RDB$FIELD_VERSIONS	One row for each version of each column definition in the database.
RDB$FIELDS	Characteristics of each domain in the database.
RDB$GRANTED_PROFILES	Description of roles and profiles granted to users and other roles.
RDB$INDEX_SEGMENTS	Columns that make up an index.

RDB$INDICES	Characteristics of the indexes for each table.
RDB$INTERRELATIONS	Interdependencies of entities used in the database.
RDB$MODULES	Module definition as defined by a user, including the header and declaration section.
RDB$OBJECT_SYNONYMS	When synonyms are enabled, this system table is created to describe the synonym name, type, and target.
RDB$PARAMETERS	Interface definition for each routine stored in RDB$ROUTINES. Each parameter to a routine (procedure or function) is described by a row in RDB$PARAMETERS.
RDB$PRIVILEGES	Protection for the database objects.
RDB$PROFILES	Description of any profiles, roles or users in the database.
RDB$QUERY_OUTLINES	Query outline definitions used by the optimizer to retrieve known query outlines prior to optimization.
RDB$RELATION_CONSTRAINTS	Lists all table-specific constraints.
RDB$RELATION_CONSTRAINT_FLDS	Lists the columns that participate in unique, primary, or foreign key declarations for table-specific constraints.
RDB$RELATION_FIELDS	Columns defined for each table.
RDB$RELATIONS	Tables and views in the database.
RDB$ROUTINES	Description of each function and procedure in the database. The routine may be standalone or part of a module.
RDB$SEQUENCES	Characteristics of any sequences defined for the database.
RDB$STORAGE_MAPS	Characteristics of each storage map.
RDB$STORAGE_MAP_AREAS	Characteristics of each partition of a storage map.
RDB$SYNONYMS	Connects an object's user-specified name to its internal database name. This table is only present in databases with the SQL multischema feature enabled.
RDB$TRIGGERS	Definition of a trigger.
RDB$VIEW_RELATIONS	Interdependencies of tables used in views.
RDB$WORKLOAD	Collects workload information.

I.6.1 RDB$CATALOG_SCHEMA

The RDB$CATALOG_SCHEMA system table contains the name and definition of each SQL catalog and schema. This table is present only in databases that have the SQL multischema feature enabled. The following table provides information on the columns of the RDB$CATALOG_SCHEMA system table.

Column Name	Data Type	Summary Description
RDB$PARENT_ID	integer	For a schema, this is the RDB$CATALOG_SCHEMA_ID of the catalog to which this schema belongs. For a catalog, this column is always 0.
RDB$CATALOG_SCHEMA_ NAME	char(31)	The name of the catalog or schema.
RDB$CATALOG_SCHEMA_ID	integer	A unique identifier indicating whether this is a catalog or a schema. Schema objects have positive identifiers starting at 1 and increasing. Catalog objects have negative identifiers starting at -1 and decreasing. 0 is reserved.
RDB$DESCRIPTION	list of byte varying	A user-supplied description of the catalog or schema.
RDB$SCHEMA_AUTH_ID	char(31)	The authorization identifier of the creator of the schema.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the schema or catalog is created.
RDB$LAST_ALTERED	date vms	Set when SQL ALTER CATALOG or ALTER SCHEMA statement is used (future).
RDB$CATALOG_SCHEMA_ CREATOR	char(31)	Creator of this schema or catalog.

I.6.2 RDB$COLLATIONS

The RDB$COLLATIONS system table describes the collating sequence to be used in the database. The following table provides information on the columns of the RDB$COLLATIONS system table.

Column Name	Data Type	Summary Description
RDB$COLLATION_NAME	char(31)	Supplies the name by which the database's collating sequences are known within the database.
RDB$COLLATION_SEQUENCE	byte varying	Internal representation of the collating sequence.
RDB$DESCRIPTION	byte varying	A user-supplied description of the collating sequence.
RDB$FLAGS	integer	A bit mask where the following bits are set: • Bit 0 If an ASCII collating sequence. • Bit 1 If a DEC_MCS collating sequence.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the collating sequence is created.
RDB$LAST_ALTERED	date vms	Reserved for future use.
RDB$COLLATION_CREATOR	char(31)	Creator of this collating sequence.

I.6.3 RDB$CONSTRAINTS

The RDB$CONSTRAINTS system table contains the name and definition of each constraint. The following table provides information on the columns of the RDB$CONSTRAINTS system table.

Column Name	Data Type	Summary Description
RDB$CONSTRAINT_NAME	char(31)	The system-wide unique name of the constraint.
RDB$CONSTRAINT_BLR	byte varying	The BLR that defines the constraint.
RDB$CONSTRAINT_SOURCE	byte varying	The user's source for the constraint.
RDB$DESCRIPTION	byte varying	A user-supplied description of this constraint.

Column Name	Data Type	Summary Description
RDB$EVALUATION_TIME	integer	A value that represents when a constraint is evaluated, as follows: • 0 At commit time (deferred initially deferred). • 1 At verb time (deferrable initially immediate). • 2 At verb time (not deferrable).
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the constraint is created.
RDB$LAST_ALTERED	date vms	Reserved for future use.
RDB$CONSTRAINT_CREATOR	char(31)	Creator of this constraint.
RDB$FLAGS	integer	Flags.

RDB$FLAGS represents flags for RDB$CONSTRAINTS system table.

Bit Position	Description
0	Currently disabled.
1	Currently enabled without validation.

I.6.4 RDB$CONSTRAINT_RELATIONS

The RDB$CONSTRAINT_RELATIONS system table lists all tables that participate in a given constraint. The following table provides information on the columns of the RDB$CONSTRAINT_RELATIONS system table.

Column Name	Data Type	Summary Description
RDB$CONSTRAINT_NAME	char(31)	The system-wide unique name of the constraint.
RDB$RELATION_NAME	char(31)	The name of a table involved in the constraint.

Column Name	Data Type	Summary Description
RDB$FLAGS	integer	Flags.
RDB$CONSTRAINT_CONTEXT	integer	The context variable of the table involved in the constraint.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$CONSTRAINT_RELATIONS system table.

Bit Position	Description
0	Reserved for future use.
1	Reserved for future use.
2	If the constraint is on the specified table.
3	If the constraint evaluates with optimization by dbkey lookup.
4	If the constraint checks for existence.
5	If the constraint checks for uniqueness.
6	If the constraint needs to evaluate on store of specified table row.
7	If the constraint need not evaluate on store of specified table row.
8	If the constraint needs to evaluate on erase of specified table row.
9	If the constraint need not evaluate on erase of specified table row.

I.6.5 RDB$DATABASE

The RDB$DATABASE system table contains information that pertains to the overall database. This table can contain only one row. The following table provides information on the columns of the RDB$DATABASE system table.

Column Name	Data Type	Summary Description
RDB$CDD_PATH	char 256	The dictionary path name for the database.
RDB$FILE_NAME	char 255	Oracle Rdb returns the file specification of the database root file. [1]

[1]The root file specification is not stored on disk (an RMU Dump command with the Areas qualifier shows that this field is blank) and is only returned to queries at runtime. Therefore, the root file specification remains correct after you use the RMU Move_Area, RMU Copy_Database, and RMU Backup commands, and the SQL EXPORT and IMPORT statements.

Column Name	Data Type	Summary Description
RDB$MAJ_VER	integer	Derived from the database major version.
RDB$MIN_VER	integer	Derived from the database minor version.
RDB$MAX_RELATION_ID	integer	The largest table identifier assigned. Oracle Rdb assigns the next table an ID of MAX_ RELATION_ID + 1.
RDB$RELATION_ID	integer	The unique identifier of the RDB$RELATIONS table. If you drop a table, that identifier is not assigned to any other table.
RDB$RELATION_ID_ROOT_ DBK	char(8)	A pointer (database key or dbkey) to the base of the RDB$REL_ REL_ID_NDX index on column RDB$RELATION_ID.
RDB$RELATION_NAME_ ROOT_DBK	char(8)	A pointer (dbkey) to the base of the RDB$REL_REL_NAME_NDX index on column RDB$RELATION_ NAME.
RDB$FIELD_ID	integer	The identifier of the RDB$FIELD_VERSIONS table.
RDB$FIELD_REL_FLD_ROOT_ DBK	char(8)	A pointer (dbkey) to the base of the RDB$VER_REL_ID_ VER_NDX index on columns RDB$RELATION_ID and RDB$VERSION.
RDB$INDEX_ID	integer	The identifier of the RDB$INDICES table.
RDB$INDEX_NDX_ROOT_DBK	char(8)	A pointer (dbkey) to the base of the RDB$NDX_NDX_NAME_NDX index on column RDB$INDEX_ NAME.
RDB$INDEX_REL_ROOT_DBK	char(8)	A pointer (dbkey) to the base of the RDB$NDX_REL_NAM_NDX index on column RDB$RELATION_ID.
RDB$INDEX_SEG_ID	integer	The identifier of the RDB$INDEX_SEGMENTS table.

Column Name	Data Type	Summary Description
RDB$INDEX_SEG_FLD_ROOT_DBK	char(8)	A pointer (dbkey) to the base of the RDB$NDX_SEG_NAM_FLD_POS_NDX index on columns RDB$INDEX_NAME and RDB$FIELD_POSITION.
RDB$SEGMENTED_STRING_ID	integer	The logical area ID that contains the segmented strings.
RDB$ACCESS_CONTROL	byte varying	The access control policy for the database.
RDB$DESCRIPTION	byte varying	A user-supplied description of the database.
RDB$DATABASE_PARAMETERS	byte varying	Reserved for future use.
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.
RDB$FLAGS	integer	Flags.
RDBVMS$MAX_VIEW_ID	integer	The largest view identifier assigned to the RDB$RELATION_ID column in the RDB$RELATIONS system table. Oracle Rdb assigns the next view an ID of MAX_VIEW_ID + 1.
RDBVMS$SECURITY_AUDIT	integer	A bit mask that indicates the privileges that will be audited for the database, as specified in the RMU Set Audit command.
RDBVMS$SECURITY_ALARM	integer	A bit mask that indicates the privileges that will produce alarms for the database, as specified in the RMU Set Audit command.
RDBVMS$SECURITY_USERS	byte varying	An access control list that identifies users who will be audited or who will produce alarms for DAC (discretionary access control) events when DACCESS (discretionary access) auditing is enabled for specific database objects.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDBVMS$SECURITY_AUDIT2	integer	Reserved for future use.
RDBVMS$SECURITY_ALARM2	integer	Reserved for future use.
RDBVMS$CHARACTER_SET_ID	integer	Value is the character set ID used for the identifier character set.

Column Name	Data Type	Summary Description
RDBVMS$CHARACTER_SET_NATIONAL	integer	Value is the character set ID used for all NCHAR (also called NATIONAL CHAR or NATIONAL CHARACTER) data types and literals.
RDBVMS$CHARACTER_SET_DEFAULT	integer	Value is the character set ID used for the default character set.
RDB$MAX_ROUTINE_ID	integer	Maintains a count of the modules and routines added to the database. Value is 0 if no routines or modules have been added to the database.
RDB$CREATED	date vms	Set when the database is created.
RDB$LAST_ALTERED	date vms	Set when SQL ALTER DATABASE statement is used.
RDB$DATABASE_CREATOR	char(31)	Creator of this database.
RDB$DEFAULT_STORAGE_AREA_ID	integer	Default storage area used for unmapped, persistent tables and indices.
RDB$DEFAULT_TEMPLATE_AREA_ID	integer	Reserved for future use.

The following ALTER DATABASE clauses modify the RDB$LAST_ALTERED column in the RDB$DATABASE system table:

- CARDINALITY COLLECTION IS {ENABLED | DISABLED}
- DICTIONARY IS [NOT] REQUIRED
- DICTIONARY IS NOT USED
- METADATA CHANGES ARE {ENABLED | DISABLED}
- MULTISCHEMA IS {ON | OFF}
- SECURITY CHECKING IS EXTERNAL (PERSONA SUPPORT IS {ENABLED | DISABLED})
- SECURITY CHECKING IS INTERNAL (ACCOUNT CHECK IS {ENABLED | DISABLED})
- SYNONYMS ARE ENABLED
- WORKLOAD COLLECTION IS {ENABLED | DISABLED}

The following SQL statements modify the RDB$LAST_ALTERED column in the RDB$DATABASE system table:

- GRANT statement
- REVOKE statement
- COMMENT ON DATABASE statement

RDB$FLAGS represents flags for RDB$DATABASE system table.

Bit Position	Description
0	If dictionary required.
1	If ANSI protection used.
2	If database file is a CDD$DATABASE database.
3	Reserved for future use.
4	Reserved for future use.
5	Reserved for future use.
6	Multischema is enabled.
7	Reserved for future use.
8	System indexes use run length compression.
9	The optimizer saves workload in RDB$WORKLOAD system table.
10	The optimizer is not updating table and index cardinalities.
11	All metadata changes are disabled.
12	Oracle Rdb uses database for user and role names.
13	If security is internal, validate the UIC. If security is external then this indicates that persona support is enabled.
14	Synonyms are supported.
15	Prefix cardinalities are not collected for system indexes.
16	If collecting, use full algorithm for system indexes.
17	Use sorted ranked index for system indexes.

I.6.6 RDB$FIELD_VERSIONS

The RDB$FIELD_VERSIONS system table is an Oracle Rdb extension. This table contains one row for each version of each column definition in the database. The following table provides information on the columns of the RDB$FIELD_VERSIONS system table.

Column Name	Data Type	Summary Description
RDB$RELATION_ID	integer	The identifier for a table within the database.
RDB$FIELD_ID	integer	An identifier used internally to name the column represented by this row.
RDB$FIELD_NAME	char(31)	The name of the column.
RDB$VERSION	integer	The version number for the table definition to which this column belongs.
RDB$FIELD_TYPE	integer	The data type of the column represented by this row. This data type must be interpreted according to the rules for interpreting the DSC$B_DTYPE field of class S descriptors (as defined in the OpenVMS Calling Standard). Segmented strings require a unique field type identifier. This identifier is currently 261.
RDB$FIELD_LENGTH	integer	The length of the column represented by this row. This length must be interpreted according to the rules for interpreting the DSC$W_LENGTH field within class S and SD descriptors (as defined in the OpenVMS Calling Standard).
RDB$OFFSET	integer	The byte offset of the column from the beginning of the row.

Column Name	Data Type	Summary Description
RDB$FIELD_SCALE	integer	For numeric data types, the scale factor to be applied when interpreting the contents of the column represented by this row. This scale factor must be interpreted according to the rules for interpreting the DSC$B_SCALE field of class SD descriptors (as defined in the OpenVMS Calling Standard). For date-time data types, RDB$FIELD_SCALE is fractional seconds precision. For other non-numeric data types, RDB$FIELD_SCALE is 0.
RDB$FLAGS	integer	Flags.
RDB$VALIDATION_BLR	byte varying	The BLR that represents the SQL check constraint clause defined in this version of the column.
RDB$COMPUTED_BLR	byte varying	The BLR that represents the SQL clause, COMPUTED BY, defined in this version of the column.
RDB$MISSING_VALUE	byte varying	The BLR that represents the SQL clause, MISSING_VALUE, defined in this version of the column.
RDB$SEGMENT_LENGTH	integer	The length of a segmented string segment. For date-time interval fields, the interval leading field precision.
RDBVMS$COLLATION_NAME	char(31)	The name of the collating sequence for the column.
RDB$ACCESS_CONTROL	byte varying	The access control list for the column.
RDB$DEFAULT_VALUE2	byte varying	The SQL default value.
RDBVMS$SECURITY_AUDIT	integer	A bit mask that indicates the privileges that will be audited for the database, as specified in the RMU Set Audit command.

Column Name	Data Type	Summary Description
RDBVMS$SECURITY_ALARM	integer	A bit mask that indicates the privileges that will produce alarms for the database, as specified in the RMU Set Audit command.
RDB$FIELD_SUB_TYPE	integer	A value that describes the data subtype of RDB$FIELD_TYPE as shown in the section for RDB$FIELD_SUB_TYPE.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$FIELD_VERSIONS system table.

Bit Position	Description
0	Not used.
1	Not used.
2	Not used.
3	Used by Oracle Rdb internally.
4	Set if column references a local temporary table (usually a COMPUTED BY column).
5	Use SQL semantics for check constraint processing.
6	AUTOMATIC set on insert.
7	AUTOMATIC set on update.
8	If check constraint fails, use name in message.
9	Column is computed by an IDENTITY sequence.
10	View column is based on a read-only, or dbkey column.

I.6.7 RDB$PARAMETER_SUB_TYPE

For details, see the section RDB$FIELD_SUB_TYPE.

I.6.8 RDB$FIELD_SUB_TYPE

The following table lists the values for the RDB$FIELD_SUB_TYPE and the RDB$PARAMETER_SUB_TYPE columns.

RDB$FIELD_TYPE = DSC$K_DTYPE_ADT	
RDB$FIELD_SUB_TYPE [1]	**Summary Description**
Less than 0	Reserved for future use.
Equal to 0	Traditional OpenVMS timestamp, which includes year, month, day, hour, minute, second.
7	DATE ANSI, which includes year, month, day.
56	TIME, which includes hour, minute, second.
63	TIMESTAMP, which includes year, month, day, hour, minute, second.
513	INTERVAL YEAR.
514	INTERVAL MONTH.
515	INTERVAL YEAR TO MONTH.
516	INTERVAL DAY.
520	INTERVAL HOUR.
524	INTERVAL DAY TO HOUR.
528	INTERVAL MINUTE.
536	INTERVAL HOUR TO MINUTE.
540	INTERVAL DAY TO MINUTE.
544	INTERVAL SECOND.
560	INTERVAL MINUTE TO SECOND.
568	INTERVAL HOUR TO SECOND.
572	INTERVAL DAY TO SECOND.

RDB$FIELD_TYPE = DSC$K_DTYPE_T or DSC$K_DTYPE_VT	
RDB$FIELD_SUB_TYPE	**Summary Description**
Equal to 0	ASCII or DEC_MCS character set.
Greater than 0	Character set other than ASCII or DEC_MCS.
Less than 0	Special use of character data.

RDB$FIELD_TYPE = DSC$K_DTYPE_BLOB [2]	
RDB$FIELD_SUB_TYPE	**Summary Description**

RDB$FIELD_TYPE = DSC$K_DTYPE_BLOB [2]	
RDB$FIELD_SUB_TYPE	**Summary Description**

Less than 0	User-specified.
Equal to 0	Default.
Equal to 1	BLR (query) type.
Equal to 2	Character type.
Equal to 3	MBLR (definition) type.
Equal to 4	Binary type.
Equal to 5	OBLR (outline) type.
Greater than 5	Reserved for future use.

I.6.9 RDB$FIELDS

The RDB$FIELDS system table describes the global (generic) characteristics of each domain in the database. There is one row for each domain in the database. The following table provides information on the columns of the RDB$FIELDS system table.

Column Name	Data Type	Summary Description
RDB$FIELD_NAME	char(31)	The name of the domain represented by this row. Each row within RDB$FIELDS must have a unique RDB$FIELD_NAME value.
RDB$FIELD_TYPE	integer	The data type of the domain represented by this row. This data type must be interpreted according to the rules for interpreting the DSC$B_DTYPE field of class S descriptors (as defined in the OpenVMS Calling Standard). Segmented strings require a unique field type identifier. This identifier is 261.

Column Name	Data Type	Summary Description
RDB$FIELD_LENGTH	integer	The length of the field represented by this row. This length must be interpreted according to the rules for interpreting the DSC$W_ LENGTH field within class S and SD descriptors (as defined in OpenVMS Calling Standard). For strings, this field contains the length in octets (8-bit bytes), not in characters.
RDB$FIELD_SCALE	integer	For numeric data types, the scale factor to be applied when interpreting the contents of the field represented by this row. This scale factor must be interpreted according to the rules for interpreting the DSC$B_SCALE field of class SD descriptors (as defined in the OpenVMS Calling Standard). For date-time data types, RDB$FIELD_SCALE is fractional seconds precision. For other non-numeric data types, RDB$FIELD_SCALE is 0.
RDB$SYSTEM_FLAG	integer	A bit mask where the following bits are set: • If Bit 0 is clear, this is a user-defined domain. • If Bit 0 is set, this is a system domain.
RDB$VALIDATION_BLR	byte varying	The BLR that represents the validation expression to be checked each time a column based on this domain is updated.
RDB$COMPUTED_BLR	byte varying	The BLR that represents the expression used to calculate a value for the column based on this domain.

Column Name	Data Type	Summary Description
RDB$EDIT_STRING	varchar(255)	The edit string used by interactive SQL when printing the column based on this domain. RDB$EDIT_STRING can be null.
RDB$MISSING_VALUE	byte varying	The value used when the missing value of the column based on this domain is retrieved or displayed. RDB$MISSING_VALUE does not store any value in a column; instead, it flags the column value as missing.
RDB$FIELD_SUB_TYPE	integer	A value that describes the data subtype of RDB$FIELD_TYPE as shown in the RDB$FIELD_SUB_TYPE section.
RDB$DESCRIPTION	byte varying	A user-supplied description of this domain.
RDB$VALIDATION_SOURCE	byte varying	The user's source text for the validation criteria.
RDB$COMPUTED_SOURCE	byte varying	The user's source used to calculate a value at execution time.
RDB$QUERY_NAME	char(31)	The query name of this domain. Column attributes in RDB$RELATION_FIELDS take precedence over attributes in RDB$FIELDS. If the attribute value is missing in RDB$RELATION_FIELDS, the value from RDB$FIELDS is used. RDB$QUERY_NAME can be null.
RDB$QUERY_HEADER	byte varying	The query header of the domain is used by interactive SQL. Column attributes in RDB$RELATION_FIELDS take precedence over attributes in RDB$FIELDS. If the attribute value is missing in RDB$RELATION_FIELDS, the value from RDB$FIELDS is used.

Column Name	Data Type	Summary Description
RDB$DEFAULT_VALUE	byte varying	The default value used by non-SQL interfaces when no value is specified for a column during a STORE clause. It differs from RDB$MISSING_VALUE in that it holds an actual column value. Column attributes in RDB$RELATION_FIELDS take precedence over attributes in RDB$FIELDS. If the attribute value is missing in RDB$RELATION_FIELDS, the value from RDB$FIELDS is used.
RDB$SEGMENT_LENGTH	integer	The length of a segmented string segment. For date-time interval fields, the interval leading field precision.
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.
RDB$CDD_NAME	byte varying	The fully qualified name of the dictionary entity upon which the domain definition is based, as specified in the SQL clause, FROM PATHNAME.
RDBVMS$COLLATION_NAME	char(31)	The name of the collating sequence for the domain.
RDB$DEFAULT_VALUE2	byte varying	The BLR for the SQL default value. This value is used when no value is provided in an SQL INSERT statement.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$FLAGS	integer	Flags.
RDB$CREATED	date vms	Set when the domain is created.
RDB$LAST_ALTERED	date vms	Set when SQL ALTER DOMAIN statement used.
RDB$FIELD_CREATOR	char(31)	Creator of this domain.

RDB$FLAGS represents flags for RDB$FIELDS system table.

Bit Position	Description
0	A SQL CHECK constraint is defined on this domain.
1	AUTOMATIC set on insert.
2	AUTOMATIC set on update.
3	If check constraint fails, use name in message.
4	Column is computed an IDENTITY sequence.
5	View column is based on a read-only, or dbkey column.

I.6.10 RDB$GRANTED_PROFILES

The RDB$GRANTED_PROFILES system table contains information about each profile, and role granted to other roles and users. The following table provides information on the columns of the RDB$GRANTED_PROFILES system table. See also the related RDB$PROFILES system table.

Column Name	Data Type	Summary Description
RDB$GRANTEE_PROFILE_ID	integer	This is a unique identifier generated for the parent RDB$PROFILES row.
RDB$PROFILE_TYPE	integer	Class of profile information: role (1), default role (2), profile (0).
RDB$PROFILE_ID	integer	Identification of the profile or role granted to this user.

I.6.11 RDB$INDEX_SEGMENTS

The RDB$INDEX_SEGMENTS system table describes the columns that make up an index's key. Each index must have at least one column within the key. The following table provides information on the columns of the RDB$INDEX_ SEGMENTS system table.

Column Name	Data Type	Summary Description
RDB$INDEX_NAME	char(31)	The name of the index of which this row is a segment.

Column Name	Data Type	Summary Description
RDB$FIELD_NAME	char(31)	The name of a column that participates in the index key. This column name matches the name in the RDB$FIELD_NAME column of the RDB$RELATION_FIELDS table.
RDB$FIELD_POSITION	integer	The ordinal position of this key segment within the total index key. No two segments in the key may have the same RDB$FIELD_ POSITION.
RDB$FLAGS	integer	A bit mask where Bit 0 is set for descending segments, otherwise the segments are ascending.
RDB$FIELD_LENGTH	integer	Shortened length of text for compressed indexes.
RDBVMS$FIELD_MAPPING_ LOW	integer	Shows the lower limit of the mapping range.
RDBVMS$FIELD_MAPPING_ HIGH	integer	Shows the higher limit of the mapping range.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CARDINALITY	bigint	Prefix cardinality for this and all prior key segments (assumes sorting by ordinal position).

I.6.12 RDB$INDICES

The RDB$INDICES system table contains information about indexes in the database. The following table provides information on the columns of the RDB$INDICES system table.

Column Name	Data Type	Summary Description
RDB$INDEX_NAME	char(31)	A unique index name.
RDB$RELATION_NAME	char(31)	The name of the table in which the index is used.

Column Name	Data Type	Summary Description
RDB$UNIQUE_FLAG	integer	A value that indicates whether duplicate values are allowed in indexes, as follows: • 0 If duplicate values are allowed. • 1 If no duplicate values are allowed.
RDB$ROOT_DBK	char(8)	A pointer to the base of the index.
RDB$INDEX_ID	integer	The identifier of the index.
RDB$FLAGS	integer	Flags.
RDB$SEGMENT_COUNT	integer	The number of segments in the key.
RDB$DESCRIPTION	byte varying	A user-supplied description of this index.
RDB$EXTENSION_PARAMETERS	byte varying	Stores NODE SIZE value, PERCENT FILL value, compression algorithm, and compression run length for this index. Also reserved for other future use.
RDB$CARDINALITY	bigint	The number of unique entries for a non-unique index. For a unique index, the number is 0.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the index is created.
RDB$LAST_ALTERED	date vms	Set when SQL ALTER INDEX statement is used.
RDB$INDEX_CREATOR	char(31)	Creator of this index.

Column Name	Data Type	Summary Description
RDB$KEY_CLUSTER_FACTOR	bigint(7)	Sorted Index: The ratio of the number of clump changes that occur when you traverse level-1 index nodes and the duplicate node chains to the number of keys in the index. This statistic is based on entire index traversal. This means last duplicate node of current key is compared with first duplicate node of next key for clump change. Hash Index: The average number of clump changes that occur when you go from system record to hash bucket to overflow hash bucket (if fragmented), and traverse the duplicate node chain for each key. This statistic is based on per key traversal.
RDB$DATA_CLUSTER_ FACTOR	bigint(7)	Sorted Index: The ratio of the number of clump changes that occur between adjacent dbkeys in duplicate chains of all keys to the number of keys in the index. For unique index, the dbkeys of adjacent keys are compared for clump change. This statistic is based on entire index traversal. This means last dbkey of current key is compared with first dbkey of next key for clump change. Hashed Index: The average number of clump changes that occur between adjacent dbkeys in a duplicate chain for each key. For a unique index, this value will be always 1. This statistic is based on per key traversal.
RDB$INDEX_DEPTH	integer	Sorted Index: The depth of the B-tree. Hashed Index: This column is not used for hashed indices and is left as 0.

RDB$FLAGS represents flags for RDB$INDICES system table.

Bit Position	Description
0	Hashed index.
1	Index segments are numeric with mapping values compression.
2	Hashed ordered index. (If bit is clear, hashed scattered.)
3	Reserved for future use.
4	Run-length compression.
5	Index is disabled or enabled deferred.
6	Build pending (enabled deferred).
7	Reserved for future use.
8	Reserved for future use.
9	Reserved for future use.
10	Reserved for future use.
11	If on, duplicates are compressed.
12	Sorted ranked index.
13	Prefix cardinalities disabled.
14	Use the full collection algorithm for prefix cardinality.
15	Index generated for a constraint when SET FLAGS 'AUTO_INDEX' was enabled.

I.6.13 RDB$INTERRELATIONS

The RDB$INTERRELATIONS system table contains information that indicates the interdependencies of objects in the database. The RDB$INTERRELATIONS table can be used to determine if an object can be dropped or if some other object depends upon its existence in the database. The following table provides information on the columns of the RDB$INTERRELATIONS system table.

Column Name	Data Type	Summary Description
RDB$OBJECT_NAME	char(31)	The name of the object that cannot be dropped or altered because it is used by some other entity in the database.
RDB$SUBOBJECT_NAME	char(31)	The name of the associated sub-object that cannot be dropped or altered because it is used by another entity in the database.

Column Name	Data Type	Summary Description
RDB$ENTITY_NAME1	char(31)	The name of the entity that depends on the existence of the object identified by the RDB$OBJECT_NAME and RDB$SUBOBJECT_NAME.
RDB$ENTITY_NAME2	char(31)	If used, the name of the entity, together with RDB$ENTITY_NAME1, that depends on the existence of the object specified in RDB$OBJECT_NAME and RDB$SUBOBJECT_NAME.
RDB$USAGE	char(31)	The relationship among RDB$OBJECT_NAME, RDB$SUBOBJECT_NAME, RDB$ENTITY_NAME1, and RDB$ENTITY_NAME2. RDB$USAGE contains a short description.
RDB$FLAGS	integer	Flags.
RDB$CONSTRAINT_NAME	char(31)	This column is the name of a constraint that is referred to from another system table. The value in this column equates to a value for the same column in the RDB$CONSTRAINTS system table.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$INTERRELATIONS system table.

Bit Position	Description
0	Entity is a module.
1	Object is a module.
2	Entity is a routine.
3	Object is a routine.
4	Entity is a trigger.
5	Object is a trigger.
6	Entity is a constraint.
7	Object is a constraint.
8	Reserved.

Bit Position	Description
9	Reserved.
10	Reserved.
11	Reserved.
12	Reserved.
13	Reserved.
14	Entity is a sequence.
15	Object is a sequence.

I.6.14 RDB$MODULES

The RDB$MODULES system table describes a module as defined by a user. A module can contain a stored procedure or an external function. Each module has a header, a declaration section, and a series of routines. The header and declaration section are defined in RDB$MODULES. (Each routine is defined by an entry in RDB$ROUTINES.) A row is stored in the RDB$MODULES table for each module that is defined by a user. The following table provides information on the columns of the RDB$MODULES system table.

Column Name	Data Type	Summary Description
RDB$MODULE_NAME	char(31)	Name of the module.
RDB$MODULE_OWNER	char(31)	Owner of the module. If the module is an invoker rights module, this column is set to NULL. Otherwise, definers username from this column is used for definers rights checking.
RDB$MODULE_ID	integer	Unique identifier assigned to this module by Oracle Rdb.
RDB$MODULE_VERSION	char(16)	Module version and checksum. Allows runtime validation of the module with respect to the database.
RDB$EXTENSION_PARAMETERS	byte varying	Encoded information for module level declarations.
RDB$MODULE_HDR_SOURCE	byte varying	Source of the module header as provided by the definer.
RDB$DESCRIPTION	byte varying	Description of the module.

Column Name	Data Type	Summary Description
RDB$ACCESS_CONTROL	byte varying	Access Control List (ACL) to control access to the module. This value can be NULL.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the module is created.
RDB$LAST_ALTERED	date vms	Set when module is altered by the ALTER, RENAME, DROP, GRANT and REVOKE statements.
RDB$MODULE_CREATOR	char(31)	Creator of this module. Differentiates between OWNER and AUTHORIZATION.
RDB$VARIABLE_COUNT	integer	Number of global variables.

I.6.15 RDB$OBJECT_SYNONYMS

The RDB$OBJECT_SYNONYMS system table is created with synonyms are enabled to record the synonym name, type, and target. The following table provides information on the columns of the RDB$OBJECT_SYNONYMS system table.

Column Name	Data Type	Summary Description
RDB$CREATED	date vms	Time and date when synonym entry was created.
RDB$LAST_ALTERED	date vms	Time and date when synonym entry was last altered.
RDB$DESCRIPTION	byte varying	A user-supplied description of the synonym.
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.
RDB$FLAGS	integer	Flags.
RDB$OBJECT_TYPE	integer	The type of synonym.
RDB$SYNONYM_NAME	char(31)	The synonym to be used by queries. This name is unique within the RDB$OBJECT_SYNONYMS system table.
RDB$SYNONYM_VALUE	char(31)	name of the object for which the synonym is defined.
RDB$SYNONYM_CREATOR	char(31)	Creator of the synonym entry.

RDB$FLAGS represents flags for RDB$OBJECT_SYNONYMS system table.

Bit Position	Description
0	When set, this bit indicates that this synonym references another synonym.
1	Reserved for future use.
2	Indicates that the synonym was created by RENAME statement.

I.6.16 RDB$PARAMETERS

The RDB$PARAMETERS system table defines the routine interface for each routine stored in RDB$ROUTINES. Each parameter to a routine (procedure or function) is described by a row in RDB$PARAMETERS. The following table provides information on the columns of the RDB$PARAMETERS system table.

Column Name	Data Type	Summary Description
RDB$PARAMETER_NAME	char(31)	Name of the parameter.
RDB$PARAMETER_SOURCE	char(31)	Source (domain or table) to the routine containing the parameter.
RDB$ROUTINE_ID	integer	Unique identifier assigned to the routine containing this parameter by Oracle Rdb.
RDB$ORDINAL_POSITION	integer	Position in parameter list. Position 0 indicates function result description.
RDB$PARAMETER_TYPE	integer	Data type of the parameter.
RDB$PARAMETER_SUB_TYPE	integer	A value that describes the data subtype of RDB$PARAMETER_ TYPE as shown in RDB$FIELD_ SUB_TYPE section.
RDB$PARAMETER_LENGTH	integer	Length of the parameter.
RDB$PARAMETER_SCALE	integer	Scale of the data type.
RDB$PARAMETER_SEG_ LENGTH	integer	The length of the segmented string segment. For date-time interval fields, the interval leading field precision.
RDB$DEFAULT_VALUE2	byte varying	Parameter default.
RDB$FLAGS	integer	Flags.
RDB$DESCRIPTION	byte varying	Description of the parameter.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$PARAMETERS system table.

Bit Position	Description
0	IN (read) INOUT (modify).
1	OUT (write) INOUT (modify).
2	Reserved for future use.
3	BY DESCRIPTOR (default is BY REFERENCE).
4	BY VALUE (Bit number 3 is ignored).
5	Reserved for future use.
6	Set if parameter mode is undefined. If Bits 0 and 1 are both clear, then the parameter is the RETURN TYPE of a function.

I.6.17 RDB$PRIVILEGES

The RDB$PRIVILEGES system table describes the protection for the database objects. There is one row per grantor, grantee, and privileges combination per entity in the database.

A row is stored in the RDB$PRIVILEGES table for each user who grants another user privileges for a database object.

If the privilege for a database object was granted without the SQL GRANT option, the row of the grantor and grantee is modified.

The privilege change takes effect at commit time of the command.

Note

The RDB$PRIVILEGES system table is used only in ANSI databases.

The following table provides information on the columns of the RDB$PRIVILEGES system table.

Column Name	Data Type	Summary Description
RDB$SUBOBJECT_ID	integer	The id of the column or routine for which protection is defined. If protection is on a database, module, table, or view, this field is NULL. The value stored in this column must be unique within the database.

Column Name	Data Type	Summary Description
RDB$OBJECT_ID	integer	The id of the module, table, sequence, or view for which protection is defined. The column is NULL if the protection is defined for the database. The value stored in this column must be unique within the database.
RDB$GRANTOR	integer	The binary format UIC of the person who defined or changed the privileges. This is usually the UIC of the person who executed the protection command. For an SQL IMPORT statement, the UIC is that of the person who originally defined the protection for the user; not necessarily the person who performed the SQL IMPORT statement.
RDB$GRANTEE	byte varying	The binary format of the UICs of the persons who hold privileges on the database object.
RDB$PRIV_GRANT	integer	Specifies the access mask of privileges that the grantee has that he can grant to other users.
RDB$PRIV_NOGRANT	integer	Specifies the access mask of privileges that the grantee has that he can use himself but cannot give to other users.
RDB$FLAGS	integer	Flags.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$PRIVILEGES system table.

Bit Position	Description
0	Privilege is defined for a module and procedure.
1	The data is related to sequences.

I.6.18 RDB$PROFILES

The RDB$PROFILES system table contains information about each profile, user and role defined for the database. The following table provides information on the columns of the RDB$PROFILES system table. See also the related RDB$GRANTED_PROFILES system table.

Column Name	Data Type	Summary Description
RDB$CREATED	date vms	time and date when profile entry was created.
RDB$LAST_ALTERED	date vms	time and date when profile entry was last altered.
RDB$DESCRIPTION	byte varying	Comment for this entry.
RDB$EXTENSION_ PARAMETERS	byte varying	Extra definitions such as default transaction.
RDB$SYSTEM_FLAG	integer	Set to TRUE (1) if this is a system define role or user, otherwise it is set to FALSE (0). When the RDB$SYSTEM_FLAG is set these entries may not be deleted by a DROP statement.
RDB$FLAGS	integer	Flags.
RDB$DEFINE_ACCESS	integer	Reserved for future use.
RDB$CHANGE_ACCESS	integer	Reserved for future use.
RDB$DELETE_ACCESS	integer	Reserved for future use.
RDB$PROFILE_ID	integer	This is a unique identifier generated for each USER, PROFILE and ROLE added to the database.
RDB$PROFILE_TYPE	integer	Class of profile information: role (1), user (3), profile (0).
RDB$PROFILE_NAME	char(31)	Name of the user, profile or role. This name is unique within the RDB$PROFILES table.
RDB$PROFILE_CREATOR	char(31)	Creator of entry.

RDB$FLAGS represents flags for RDB$PROFILES system table.

Bit Position	Description
0	The user entry is disabled (ACCOUNT LOCK).
1	Means that the user/role is identified externally.
2	Reserved for future use.
3	This is a system role.
4	Means the user is assigned a profile.

I.6.19 RDB$QUERY_OUTLINES

The RDB$QUERY_OUTLINES system table contains query outline definitions that are used by the optimizer to retrieve known query outlines prior to optimization. The following table provides information on the columns of the RDB$QUERY_OUTLINES system table.

Column Name	Data Type	Summary Description
RDB$OUTLINE_NAME	char(31)	The query outline name.
RDB$BLR_ID	char 16	The BLR hashed identifier. This identifier is generated by the optimizer whenever a query outline is created.
RDB$MODE	integer	The query mode (MANDATORY or OPTIONAL).
RDB$FLAGS	integer	Flags.
RDB$DESCRIPTION	byte varying	A user-supplied description of this outline.
RDB$OUTLINE_BLR	byte varying	The compiled query outline.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the outline is created.
RDB$LAST_ALTERED	date vms	Reserved for future use.
RDB$OUTLINE_CREATOR	char(31)	Creator of this outline.

RDB$FLAGS represents flags for RDB$QUERY_OUTLINES system table.

Bit Position	Description
0	This outline has been invalidated by some action, such as dropping a required table or index.

I.6.20 RDB$RELATION_CONSTRAINTS

The RDB$RELATION_CONSTRAINTS system table lists all table-specific constraints. The following table provides information on the columns of the RDB$RELATION_CONSTRAINTS system table.

Column Name	Data Type	Summary Description
RDB$CONSTRAINT_MATCH_ TYPE	integer	The match type associated with a referential integrity table-specific constraint. This column is reserved for future use. The value is always 0.
RDB$CONSTRAINT_NAME	char(31)	The name of the constraint defined by the table specified by RDB$RELATION_NAME. The value in this column equates to a value for the same column in the RDB$CONSTRAINTS system table.
RDB$CONSTRAINT_SOURCE	byte varying	This text string contains the source of the constraint from the table definition.
RDB$CONSTRAINT_TYPE	integer	The type of table-specific constraint defined. The values are shown in the RDB$CONSTRAINT_TYPE section.
RDB$ERASE_ACTION	integer	The type of referential integrity erase action specified. This column is reserved for future use. The value is always 0.
RDB$FIELD_NAME	char(31)	The name of the column for which a column-level, table-specific constraint is defined. The column is blank for a table-level constraint.
RDB$FLAGS	integer	Flags.
RDB$MODIFY_ACTION	integer	The type of referential integrity modify action specified. This column is reserved for future use. The value is always 0.

Column Name	Data Type	Summary Description
RDB$REFD_CONSTRAINT_ NAME	char(31)	The name of the unique or primary key constraint referred to by a referential integrity foreign key constraint. If the constraint is not a referential integrity constraint or no referential integrity constraint was specified, this column will be null. Otherwise, the value in this column will equate to a value for the same columns in the RDB$CONSTRAINTS and RDB$RELATION_CONSTRAINT_ FLDS system tables. This column is used to determine the foreign key referenced table name and referenced column names.
RDB$RELATION_NAME	char(31)	The name of the table on which the specified constraint is defined. The value in this column equates to a value for the same column in the RDB$RELATIONS system table.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$RELATION_CONSTRAINTS system table.

Bit Position	Description
0	This is SQL standard UNIQUE constraint which allows unique values and ignores NULL.

I.6.20.1 RDB$CONSTRAINT_TYPE

The following table lists the values for the RDB$CONSTRAINT_TYPE column.

Value	Symbol	Meaning
1	RDB$K_CON_CONDITION	Requires conditional expression constraint.
2	RDB$K_CON_PRIMARY_KEY	Primary key constraint.

Value	Symbol	Meaning
3	RDB$K_CON_REFERENTIAL	Referential (foreign key) constraint.
4	RDB$K_CON_UNIQUE	Unique constraint.
5		Reserved for future use.
6	RDB$K_CON_NOT_NULL	Not null (missing) constraint.

I.6.21 RDB$RELATION_CONSTRAINT_FLDS

The RDB$RELATION_CONSTRAINT_FLDS system table lists the columns that participate in unique, primary, or foreign key declarations for table-specific constraints.

There is one row for each column that represents all or part of a unique, primary, or foreign key constraint.

The following table provides information on the columns of the RDB$RELATION_CONSTRAINT_FLDS system table.

Column Name	Data Type	Summary Description
RDB$CONSTRAINT_NAME	char(31)	The name of a constraint for which the specified column participates.
RDB$FIELD_NAME	char(31)	The name of the column that is all or part of the specified constraint. The value in this column is the same as that stored in the RDB$RELATION_FIELDS system table.
RDB$FIELD_POSITION	integer	The ordinal position of the specified column within the column list that declares the unique, primary or foreign key constraint. For column-level constraints, there will always be only one column in the list. The first column in the list has position value 1, the second has position value 2, and so on.
RDB$FLAGS	integer	Reserved for future use.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

I.6.22 RDB$RELATION_FIELDS

The RDB$RELATION_FIELDS system table contains one row for each column in each table. The following table provides information on the columns of the RDB$RELATION_FIELDS system table.

Column Name	Data Type	Summary Description
RDB$RELATION_NAME	char(31)	The name of the table that contains the column represented by this row.
RDB$FIELD_NAME	char(31)	The name of the column represented by this row within the table. Each RDB$RELATION_FIELDS row that has the same RDB$RELATION_NAME must have a unique RDB$FIELD_NAME.
RDB$FIELD_SOURCE	char(31)	The name of the domain (from the RDB$FIELD_NAME column within the RDB$FIELDS table) that supplies the definition for this column.
RDB$FIELD_ID	integer	An identifier that can be used within the BLR to name the column represented by this row. Oracle Rdb assigns each column an id that is permanent for as long as the column exists within the table.
RDB$FIELD_POSITION	integer	The ordinal position of the column represented by this row, relative to the other columns in the same table.
RDB$QUERY_NAME	char(31)	The query name of this column. RDB$QUERY_NAME can be null.
RDB$UPDATE_FLAG	integer	A value that indicates whether a column can be updated: • 0 If column cannot be updated. • 1 If column can be updated.

Column Name	Data Type	Summary Description
RDB$QUERY_HEADER	byte varying	The query header of this column for use by SQL. Column attributes in RDB$RELATION_FIELDS take precedence over RDB$FIELDS. If the attribute value is missing in RDB$RELATION_FIELDS, SQL uses the value from RDB$FIELDS.
RDB$DESCRIPTION	byte varying	A user-supplied description of the contents of this row.
RDB$VIEW_CONTEXT	integer	For view tables, this column identifies the context variable used to qualify the view column. This context variable must be defined within the row selection expression that defines the view. The context variable appears in the BLR represented by the column RDB$VIEW_BLR in RDB$RELATIONS.
RDB$BASE_FIELD	char(31)	The local name of the column used as a component of a view. The name is qualified by the context variable identified in RDB$VIEW_CONTEXT.
RDB$DEFAULT_VALUE	byte varying	The default value used by non-SQL interfaces when no value is specified for a column during a STORE clause. It differs from RDB$MISSING_VALUE in that it holds an actual column value. Column attributes in RDB$RELATION_FIELDS take precedence over attributes in RDB$FIELDS. If the attribute value is missing in RDB$RELATION_FIELDS, the value from RDB$FIELDS is used.
RDB$EDIT_STRING	varchar(255)	The edit string to be used by interactive SQL when printing the column. RDB$EDIT_STRING can be null.
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.

Column Name	Data Type	Summary Description
RDB$ACCESS_CONTROL	byte varying	The access control list for the column.
RDB$DEFAULT_VALUE2	byte varying	The BLR for SQL default value. This value is used when no value is provided in an SQL INSERT statement.
RDBVMS$SECURITY_AUDIT	integer	A bit mask that indicates the privileges that will be audited for the database, as specified in the RMU Set Audit command.
RDBVMS$SECURITY_ALARM	integer	A bit mask that indicates the privileges that will produce alarms for the database, as specified in the RMU Set Audit command.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

I.6.23 RDB$RELATIONS

The RDB$RELATIONS system table names all the tables and views within the database. There is one row for each table or view. The following table provides information on the columns of the RDB$RELATIONS system table.

Column Name	Data Type	Summary Description
RDB$RELATION_NAME	char(31)	The name of a table within the database. Each row within RBB$RELATIONS must have a unique RDB$RELATION_NAME.
RDB$RELATION_ID	integer	An identification number used within the BLR to identify a table.
RDB$STORAGE_ID	integer	A pointer to the database logical area where the data for this table is stored.

Column Name	Data Type	Summary Description
RDB$SYSTEM_FLAG	integer	A value that indicates whether a table is a system table or a user-defined table: • 0 If a user table. • 1 If a system table.
RDB$DBKEY_LENGTH	integer	The length in bytes of the database key. A database key for a row in a table is 8 bytes, and "n times 8 " for a view row, where "n" is the number of tables referred to in the view. If the view does not contain a dbkey, RDB$DBKEY_LENGTH is 0. This occurs when the view uses GROUP BY, UNION, or returns a statistical value.
RDB$MAX_VERSION	integer	The number of the current version of the table definition. This value is matched with the RDB$VERSION column in RDB$FIELD_VERSIONS to determine the current row format for the table.
RDB$CARDINALITY	bigint	The number of rows in the table (cardinality).
RDB$FLAGS	integer	Flags.
RDB$VIEW_BLR	byte varying	The BLR that describes the row selection expression used to select the rows for the view. If the table is not a view, RDB$VIEW_BLR is missing.
RDB$DESCRIPTION	byte varying	A user-supplied description of this table or view.
RDB$VIEW_SOURCE	byte varying	The user's source text for the view definition.
RDB$ACCESS_CONTROL	byte varying	The access control policy for the table.

Column Name	Data Type	Summary Description
RDB$EXTENSION_PARAMETERS	byte varying	Reserved for future use.
RDB$CDD_NAME	byte varying	The fully qualified name of the dictionary entity upon which the table definition is based, as specified in the SQL clause, FROM PATHNAME.
RDBVMS$SECURITY_AUDIT	integer	A bit mask that indicates the privileges that will be audited for the table, as specified in the RMU Set Audit command.
RDBVMS$SECURITY_ALARM	integer	A bit mask that indicates the privileges that produce alarms for the table, as specified in the RMU Set Audit command.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDBVMS$SECURITY_AUDIT2	integer	Reserved for future use.
RDBVMS$SECURITY_ALARM2	integer	Reserved for future use.
RDB$CREATED	date vms	Set when the table or view is created (for system tables it will be the same as the database creation timestamp).
RDB$LAST_ALTERED	date vms	Set when SQL ALTER TABLE, CREATE/ALTER STORAGE MAP, ALTER DOMAIN, GRANT, or REVOKE statements cause changes to this system table.
RDB$RELATION_CREATOR	char(31)	Creator of this system table.
RDB$ROW_CLUSTER_FACTOR	bigint(7)	The ratio of the number of clump changes that occur when you sequentially read the rows to the number of rows in a table. If a row is fragmented and part of its fragment is located in a clump different than the current one or immediate next one then it should be counted as a clump change.
RDB$TYPE_ID	integer	Reserved for future use.

RDB$FLAGS represents flags for RDB$RELATIONS system table.

Bit Position	Description
0	This table is a view.
1	This table is not compressed.
2	The SQL clause, WITH CHECK OPTION, is used in this view definition.
3	Indicates a special internal system table.
4	This view is not an ANSI updatable view.
5	Reserved for future use.
6	Reserved for future use.
7	Reserved for future use.
8	Ignore Bit 1 and use RDB$STORAGE_MAPS for compression information.
9	Set for temporary table.
10	Set for global temporary table; clear for local temporary table.
11	Set for delete data on commit; clear for preserve data on commit.
12	Reserved for future use.
13	Set if view or table references a local temporary table.
14	Special read-only information table.
15	System table has storage map.
16	View references only temporary table.

I.6.24 RDB$ROUTINES

The RDB$ROUTINES system table describes each routine that is part of a stored module or a standalone external routine. An external routine can either be part of a module or standalone (outside the context of a module). The following table provides information on the columns of the RDB$ROUTINES system table.

Column Name	Data Type	Summary Description
RDB$ROUTINE_NAME	char(31)	Name of the routine.
RDB$GENERIC_ROUTINE_NAME	char(31)	Reserved for future use.
RDB$MODULE_ID	integer	The identifier of the module that contains this routine. If routine is standalone, value is 0.

Column Name	Data Type	Summary Description
RDB$ROUTINE_ID	integer	Unique identifier assigned to this routine.
RDB$ROUTINE_VERSION	char(16)	Routine version and checksum. Allows runtime validation of the routine with respect to the database.
RDB$PARAMETER_COUNT	integer	The number of parameters for this routine.
RDB$MIN_PARAMETER_ COUNT	integer	Minimum number of parameters for this routine.
RDB$ROUTINE_BLR	byte varying	The BLR for this routine. If the routine is external, this column is set to NULL.
RDB$ROUTINE_SOURCE	byte varying	Source of the routine as provided by the definer.
RDB$FLAGS	integer	Flags.
RDB$SOURCE_LANGUAGE	integer	The RDB$SOURCE_LANGUAGE section lists the values for this column.
RDB$DESCRIPTION	byte varying	Description of the routine.
RDB$ACCESS_CONTROL	byte varying	The access control list (ACL) to control access to the routine. This value can be NULL.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$EXTENSION_PARAMETERS	byte varying	Stores interface information about the routine. This includes parameter mappings, the shareable image name, and entry point name.
RDB$TYPE_ID	integer	Reserved for future use.
RDB$ROUTINE_OWNER	char(31)	Owner of the routine. This column is only used when the routine is standalone (when RDB$MODULE_ ID is 0) otherwise the value is NULL.
RDB$CREATED	date vms	Set when the routine is created (the same as the parent module's creation timestamp).

Column Name	Data Type	Summary Description
RDB$LAST_ALTERED	date vms	Set when the routine is modified by the ALTER, RENAME, GRANT, and REVOKE statements.
RDB$ROUTINE_CREATOR	char(31)	Creator of this routine. Differentiates between AUTHORIZATION and OWNER.

RDB$FLAGS represents flags for RDB$ROUTINES system table.

Bit Position	Description
0	Routine is a function. (Call returns a result.)
1	Routine is not valid. (Invalidated by a metadata change.)
2	The function is not deterministic (that is, the routine is variant). A subsequent invocation of the routine with identical parameters may return different results.
3	Routine can change the transaction state.
4	Routine is a secured shareable image.
5	Reserved for future use.
6	Routine is not valid. (Invalidated by a metadata change to the object upon which this routine depends. This dependency is a language semantics dependency.)
7	Reserved for future use.
8	External function returns NULL when called with any NULL parameter.
9	Routine has been analyzed (used for trigger dependency tracking).
10	Routine inserts rows.
11	Routine modifies rows.
12	Routine deletes rows.
13	Routine selects rows.
14	Routine calls other routines.
15	Reserved for future use.
16	Routine created with USAGE IS LOCAL clause.
17	Reserved for future use.
18	Reserved for future use.

Bit Position	Description
19	Routine is a SYSTEM routine.
20	Routine generated by Oracle Rdb.
	Other bits are reserved for future use.

I.6.24.1 RDB$SOURCE_LANGUAGE

The following table lists the values for the RDB$SOURCE_LANGUAGE column.

Value	Language
0	Language undefined
1	Ada
2	C
3	COBOL
4	FORTRAN
5	Pascal
6	Reserved for future use.
7	BASIC
8	GENERAL
9	PL/I
10	SQL - default for stored functions and stored procedures

I.6.25 RDB$SEQUENCES

The RDB$SEQUENCES system table contains information about each sequence. The following table provides information on the columns of the RDB$SEQUENCES system table.

Column Name	Data Type	Summary Description
RDB$CREATED	date vms	Time sequence was created.
RDB$LAST_ALTERED	date vms	Last time sequence was altered.
RDB$ACCESS_CONTROL	byte varying	Access control list for this sequence.
RDB$DESCRIPTION	byte varying	Description provided for this sequence.

Column Name	Data Type	Summary Description
RDB$START_VALUE	bigint	Starting value for the sequence.
RDB$MINIMUM_SEQUENCE	bigint	Minimum value for the sequence.
RDB$MAXIMUM_SEQUENCE	bigint	Maximum value for the sequence.
RDB$NEXT_SEQUENCE_ VALUE	bigint	Next value available for use for the sequence. This column is a read only COMPUTED BY column. When the sequence is first defined this column returns NULL.
RDB$INCREMENT_VALUE	integer	Increment value for the sequence. A positive value indicates an ascending sequence, and a negative value indicates a descending sequence.
RDB$CACHE_SIZE	integer	Number of sequence numbers to allocate and hold in memory. If one (1), then NOCACHE was specified and the values will be allocated one at a time.
RDB$FLAGS	integer	Flags.
RDB$SEQUENCE_ID	integer	Unique number assigned to this sequence object. This value is for internal use only.
RDB$SEQUENCE_NAME	char(31)	Unique name of the sequence.
RDB$SEQUENCE_CREATOR	char(31)	Creator of this sequence.

RDB$FLAGS represents flags for RDB$SEQUENCES system table.

Bit Position	Description
0	Sequence will cycle.
1	Sequence is ordered.
2	Sequence is random.
3	Indicates that this is a system sequence and may not be dropped.
4	Indicates that there was no minimum value specified.
5	Indicates that there was no maximum value specified.
6	Indicates that this is a column IDENTITY sequence.
7	Indicates that this sequence will wait for locks.

Bit Position	Description
8	Indicates that this sequence will not wait for locks.

I.6.26 RDB$STORAGE_MAPS

The RDB$STORAGE_MAPS system table contains information about each storage map. The following table provides information on the columns of the RDB$STORAGE_MAPS system table.

Column Name	Data Type	Summary Description
RDB$MAP_NAME	char(31)	The name of the storage map.
RDB$RELATION_NAME	char(31)	The name of the table to which the storage map refers.
RDB$INDEX_NAME	char(31)	The name of the index specified in the SQL clause, PLACEMENT VIA INDEX, of the storage map.
RDB$FLAGS	integer	Flags.
RDB$MAP_SOURCE	byte varying	The user's source text for the storage map definition.
RDB$DESCRIPTION	byte varying	A user-supplied description of the storage map.
RDB$EXTENSION_PARAMETERS	byte varying	Lists the column names for vertical record partitioning.
RDB$VERTICAL_PARTITION_INDEX	integer	A counter that indicates the number of vertical record partitions. If vertical record partitioning is used, there is one RDB$STORAGE_MAPS for each vertical partition.
RDB$VERTICAL_PARTITION_NAME	char(31)	Name of the vertical record partition.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

RDB$FLAGS represents flags for RDB$STORAGE_MAPS system table.

Bit Position	Description
0	If map is for a mixed format area.
1	If map enables compression.

Bit Position	Description
2	Partition key cannot be updated.
3	Reserved for future use.
4	User named this partition.
5	Override used for strict partitioning - NO REORGANIZE.

I.6.27 RDB$STORAGE_MAP_AREAS

The RDB$STORAGE_MAP_AREAS system table contains information about each storage area to which a storage map refers. The following table provides information on the columns of the RDB$STORAGE_MAP_AREAS system table.

Column Name	Data Type	Summary Description
RDB$MAP_NAME	char(31)	The name of the storage map.
RDB$AREA_NAME	char(31)	The name of the storage area referred to by the storage map.
RDB$ROOT_DBK	char(8)	A pointer to the root of the SORTED index, if it is a SORTED index.
RDB$ORDINAL_POSITION	integer	The order of the storage area represented by this row in the map.
RDB$STORAGE_ID	integer	For a table, a pointer to the database logical area. For a hashed index, a pointer to the system record.
RDB$INDEX_ID	integer	A pointer to the index logical area.
RDB$STORAGE_BLR	byte varying	The BLR that represents the SQL clause, WITH LIMIT OF, in the storage map definition.
RDB$DESCRIPTION	byte varying	Description of this partition.
RDB$EXTENSION_PARAMETERS	byte varying	Lists table names and column names that are referenced by segmented string storage maps.
RDB$VERTICAL_PARTITION_INDEX	integer	For LIST storage maps, the value indicates the relationship between areas of a LIST storage map area set.

Column Name	Data Type	Summary Description
RDB$FLAGS	integer	Flags.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$PARTITION_NAME	char(31)	Name of the index or storage map partition.

RDB$FLAGS represents flags for RDB$STORAGE_MAP_AREAS system table.

Bit Position	Description
0	If Bit 0 is clear, the LIST storage area set is filled randomly. If Bit 0 is set, the LIST storage area set is filled sequentially.
1	User named this partition.
2	BUILD PARTITION is required.
3	Deferred build using NOLOGGING.

I.6.28 RDB$SYNONYMS

The RDB$SYNONYMS system table connects the user-visible name of an object to the stored name of an object. The user-visible name of an object might be replicated in multiple schemas, whereas the stored name of an object is unique across all schemas and catalogs. This table is present only in databases that have the SQL multischema feature enabled.

Unlike rows in other system tables, the rows in the RDB$SYNONYMS system table are compressed. The following table provides information on the columns of the RDB$SYNONYMS system table.

Column Name	Data Type	Summary Description
RDB$SCHEMA_ID	integer	The RDB$CATALOG_SCHEMA_ID of the schema to which this object belongs.
RDB$USER_VISIBLE_NAME	char(31)	The name of an object as it appears to the user.

Column Name	Data Type	Summary Description
RDB$OBJECT_TYPE	integer	A value that represents the type of an object, as follows: • 8 A constraint. • 19 A domain (global field). • 26 An index. • 31 A relation (table). • 36 A view. • 60 A sequence. • 67 A storage map. • 81 A trigger. • 117 A collating sequence. • 180 An outline. • 192 A type.
RDB$STORED_NAME	char(31)	The name of an object as is actually stored in the database.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

I.6.29 RDB$TRIGGERS

The RDB$TRIGGERS system table describes the definition of a trigger. The following table provides information on the columns of the RDB$TRIGGERS system table.

Column Name	Data Type	Summary Description
RDB$DESCRIPTION	byte varying	A user-supplied text string describing the trigger.
RDB$FLAGS	integer	Flags.
RDB$RELATION_NAME	char(31)	The name of the table for which this trigger is defined. The trigger may be selected on an update to the named table (qualified by the columns described in the RDB$TRIGGER_FIELD_NAME_ LIST). This table is used as a subject table for all contexts that refer to it.
RDB$TRIGGER_ACTIONS	byte varying	A text string containing all the sets of triggered actions defined for this trigger. The string consists of one or more sets of clumplets, one set for each triggered action.
RDB$TRIGGER_CONTEXTS	integer	The context number used within the triggered action BLR to map the triggered action BLR to the current context of the triggering update statement.
RDB$TRIGGER_FIELD_NAME_ LIST	byte varying	A text string composed of a count field and one or more counted strings. The count is an unsigned word that represents the number of strings in the list. The counted strings are ASCIC names that represent column names. If the trigger is of event type UPDATE, it will be evaluated if one or more of the specified columns has been modified.
RDB$TRIGGER_NAME	char(31)	The name of a trigger. This name must be a unique trigger name within the database.

Column Name	Data Type	Summary Description
RDB$TRIGGER_NEW_ CONTEXT	integer	A context number used within the triggered action's BLR to refer to the new row values for the subject table for an UPDATE event.
RDB$TRIGGER_OLD_ CONTEXT	integer	A context number used within the triggered action's BLR to refer to the old row values of the subject table that existed before an UPDATE event.
RDB$TRIGGER_SOURCE	byte varying	An optional text string for the trigger definition. The string is not used by the database system. It should reflect the full definition of the trigger. This column is used by the interfaces to display the trigger definition.
RDB$TRIGGER_TYPE	integer	The type of trigger, as defined by the combination of the trigger action time and the trigger event. Action times are BEFORE and AFTER, and events are INSERT, DELETE, and UPDATE. The values that represent the type of trigger are shown in the TRIGGER_TYPE_VAL section.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.
RDB$CREATED	date vms	Set when the trigger is created.
RDB$LAST_ALTERED	date vms	Set when SQL ALTER TRIGGER statement is used.
RDB$TRIGGER_CREATOR	char(31)	Creator of this trigger.
RDB$EXTENSION_PARAMETERS	byte varying	Extension parameters.

RDB$FLAGS represents flags for RDB$TRIGGERS system table.

Bit Position	Description
0	Trigger is currently disabled.
1	Invalid due to changed schema.
2	Referenced table was altered.

I.6.29.1 TRIGGER_TYPE_VAL

The following table lists the values for the RDB$TRIGGER_TYPE column of the RDB$TRIGGERS system table and the different types of triggers they represent.

Numeric Value	Symbolic Value	Description
1	RDB$K_BEFORE_STORE	Trigger is evaluated before an INSERT.
2	RDB$K_BEFORE_ERASE	Trigger is evaluated before a DELETE.
3	RDB$K_BEFORE_MODIFY	Trigger is evaluated before an UPDATE.
4	RDB$K_AFTER_STORE	Trigger is evaluated after an INSERT.
5	RDB$K_AFTER_ERASE	Trigger is evaluated after a DELETE.
6	RDB$K_AFTER_MODIFY	Trigger is evaluated after an UPDATE.

I.6.30 RDB$VIEW_RELATIONS

The RDB$VIEW_RELATIONS system table lists all the tables that participate in a given view. There is one row for each table or view in a view definition. The following table provides information on the columns of the RDB$VIEW_RELATIONS system table.

Column Name	Data Type	Summary Description
RDB$VIEW_NAME	char(31)	Names a view or table that uses another table. The value of RDB$VIEW_NAME is normally a view name, but might also be the name of a table that includes a column computed using a statistical expression.
RDB$RELATION_NAME	char(31)	The name of a table used to form the view.

Column Name	Data Type	Summary Description
RDB$VIEW_CONTEXT	integer	An identifier for the context variable used to identify a table in the view. The context variable appears in the BLR represented by the column RDB$VIEW_BLR in RDB$RELATIONS.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

I.6.31 RDB$WORKLOAD

The RDB$WORKLOAD system table is an optional system table (similar to RDB$SYNONYMS and RDB$CATALOG_SCHEMA). It is created when the database attribute WORKLOAD COLLECTION IS ENABLED is specified on an SQL CREATE or ALTER DATABASE statement. Once created, this system table can never be dropped.

The following table provides information on the columns of the RDB$WORKLOAD system table.

Column Name	Data Type	Summary Description
RDB$CREATED	date vms	Time workload entry was created.
RDB$LAST_ALTERED	date vms	Last time statistics were updated.
RDB$DUPLICITY_FACTOR	bigint(7)	Value ranges from 1.0 to table cardinality. Number of duplicate values for an interesting column group (RDB$FIELD_GROUP).
RDB$NULL_FACTOR	integer(7)	Value ranges from 0.0 to 1.0. This is the proportion of table rows that have NULL in one or more columns of an interesting column group.
RDB$RELATION_ID	integer	Base table identifier.
RDB$FLAGS	integer	Reserved for future use.
RDB$FIELD_GROUP	char(31)	Contains up to 15 sorted column identifiers.
RDB$SECURITY_CLASS	char(20)	Reserved for future use.

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