SYBASE®
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Embedded SQL™/COBOL Programmers Guide

Open Client™

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Contents

About This Book

This book explains how to use Embedded SQL™ and the Embedded SQL precompiler with COBOL applications. Embedded SQL is a superset of Transact-SQL® that lets you place Transact-SQL statements in application programs written in languages such as COBOL and C.

The information in this book is platform-independent. For platform-specific instructions on using Embedded SQL, see the *Open Client™ and Open Server™ Programmers Supplement*.

Audience

This book is intended for application developers and others interested in Embedded SQL concepts and uses. To use this guide, you should:

- Be familiar with the information in the *Adaptive Server® Enterprise Reference Manual*
- Have COBOL programming experience

How to use this book

This book contains these chapters:

- Chapter 1, "Introduction," presents a brief overview of Embedded SQL and describes its advantages and capabilities.
- Chapter 2, "General Information," describes the tasks of an Embedded SQL program and provides general rules for programming with Embedded SQL.
- Chapter 3, "Communicating with Adaptive Server Enterprise," describes how to establish and use a communication area with SQLCA, SQLCODE, and SQLSTATE. This chapter also describes the system variables used in the communication area.
- Chapter 4, "Using Variables," explains how to declare and use host and indicator variables in Embedded SQL. This chapter also describes arrays and explains **datatype** conversions.
- Chapter 5, "Connecting to Adaptive Server Enterprise," explains how to use Embedded SQL to connect an application program to Adaptive Server® Enterprise and data servers in general.

- Chapter 6, “Using Transact-SQL Statements,” describes how to use Transact-SQL in an Embedded SQL application program. This chapter describes how to select rows using arrays and batches, and how to group Transact-SQL statements.
- Chapter 7, “Using Dynamic SQL,” describes how to create Embedded SQL statements that your application’s users can enter interactively at runtime.
- Chapter 8, “Handling Errors,” describes return codes and the Embedded SQL precompiler’s facilities for detecting and handling errors.
- Chapter 9, “Embedded SQL Statements: Reference Pages,” provides a reference page for each Embedded SQL statement.
- Chapter 10, “Open Client/Server Configuration File,” describes the use of an external configuration file with Embedded SQL.
- Appendix A, “Precompiler Warning and Error Messages,” lists precompiler and runtime messages.
- The Glossary defines many of the terms used in this documentation.

Related documents

You can see these books for more information:

- The *Open Server and SDK New Features for Windows, Linux, and UNIX*, which describes new features available for Open Server and the Software Developer’s Kit. This document is revised to include new features as they become available.
- The *Open Server Release Bulletin* for your platform contains important last-minute information about Open Server.
- The *Software Developer’s Kit Release Bulletin* for your platform contains important last-minute information about Open Client™ and SDK.
- The *jConnect™ for JDBC™ Release Bulletin* contains important last-minute information about jConnect.
- The *Open Client and Open Server Configuration Guide* for your platform contains information about configuring your system to run Open Client and Open Server.
- The *Open Client Client-Library/C Programmers Guide* contains information on how to design and implement Client-Library applications.
- The *Open Client Client-Library/C Reference Manual* contains reference information for Open Client Client-Library™.

- The *Open Server Server-Library/C Reference Manual* contains reference information for Open Server Server-Library.
- The *Open Client and Open Server Common Libraries Reference Manual* contains reference information for CS-Library, which is a collection of utility routines that are useful in both Client-Library and Server-Library applications.
- The *Open Server DB-Library/C Reference Manual* contains reference information for the C version of Open Client DB-Library™.
- The *Open Client and Open Server Programmers Supplement* for your platform contains platform-specific information for programmers using Open Client and Open Server. This document includes information about:
  - Compiling and linking an application
  - The sample programs that are included with Open Client and Open Server
  - Routines that have platform-specific behaviors
- The *Installation and Release Bulletin Sybase® SDK DB-Library Kerberos Authentication Option* contains information about installing and enabling the MIT Kerberos security mechanism to be used on DB-Library. DB-Library only supports network authentication and mutual authentication in the Kerberos security mechanism.
- The *Open Client and Open Server International Developers Guide* provides information about creating internationalized and localized applications.
- The *Open Client Embedded SQL™/C Programmers Guide* explains how to use Embedded SQL and the Embedded SQL precompiler with C applications.
- The *jConnect for JDBC Programmers Reference* describes the jConnect for JDBC product and explains how to access data stored in relational database management systems.
- The *Adaptive Server Enterprise ADO.NET Data Provider Users Guide* provides information on how to access data in Adaptive Server using any language supported by .NET, such as C#, Visual Basic .NET, C++ with managed extension, and J#.

- The *Adaptive Server Enterprise ODBC Driver by Sybase Users Guide* for Microsoft Windows and UNIX, provides information on how to access data from Adaptive Server on Microsoft Windows and UNIX platforms, using the Open Database Connectivity (ODBC) Driver.
- The *Adaptive Server Enterprise OLE DB Provider by Sybase Users Guide for Microsoft Windows* provides information on how to access data from Adaptive Server on Microsoft Windows platforms, using the Adaptive Server OLE DB Provider.
- The *Adaptive Server Enterprise Database Driver for Perl Programmers Guide* provides information for Perl developers to connect to an Adaptive Server database and query or change information using a Perl script.
- The *Adaptive Server Enterprise extension module for PHP Programmers Guide* provides information for PHP developers to execute queries against an Adaptive Server database.
- The *Adaptive Server Enterprise extension module for Python Programmers Guide* provides information about Sybase-specific Python interface that can be used to execute queries against an Adaptive Server database.

Other sources of information

Use the Sybase® Product Documentation Web site to learn more about your product:

- The Sybase Product Documentation Web site is accessible using a standard Web browser. In addition to product documentation, you will find links to EBFs/Maintenance, Technical Documents, Case Management, Solved Cases, newsgroups, and the Sybase Developer Network.

  To access the Sybase Product Documentation Web site, go to Product Documentation at http://www.sybase.com/support/manuals/.

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5. Click the Info icon to display the EBF/Maintenance report, or click the product description to download the software.

Conventions

Table 1: Syntax conventions

Key	Definition
command	Command names, command option names, utility names, utility flags, and other keywords are in sans serif font.
variable	Variables, or words that stand for values that you fill in, are in *italics*.
{ }	Curly braces indicate that you choose at least one of the enclosed options. Do not include the braces in the command.
[ ]	Brackets mean choosing one or more of the enclosed items is optional. Do not include the braces in the command.
( )	Parentheses are to be typed as part of the command.
|	The vertical bar means you can select only one of the options shown.
,	The comma means you can choose as many of the options shown as you like, separating your choices with commas to be typed as part of the command.

Accessibility features

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CHAPTER 1

Introduction

This chapter includes the following topics to introduce Embedded SQL and the Embedded SQL precompiler.

Embedded SQL overview

Embedded SQL is a superset of Transact-SQL that lets you place Transact-SQL statements in application programs written in languages such as COBOL and C.

Embedded SQL is a product that enables you to create programs that access and update Adaptive Server Enterprise data. Embedded SQL programmers write SQL statements directly into an application program written in a conventional programming language such as C or COBOL. A preprocessing program—the Embedded SQL precompiler—processes the completed application program, resulting in a program that the host language compiler can compile. The program is linked with Open Client Client-Library before it is executed.

Embedded SQL is one of the two programming methods Sybase provides for accessing Adaptive Server Enterprise. The other programming method is the call-level interface. With the call-level interface, you place Client-Library calls directly into an application program and then link with Client-Library.

You can place Embedded SQL statements anywhere in a **host program** and mix them with host language statements. All Embedded SQL statements must begin with the keywords exec sql and end with end-exec.

You can use *host variables* in Embedded SQL statements to store data retrieved from Adaptive Server Enterprise and as parameters in Embedded SQL statements; for example, in the where clause of a select statement. In **Dynamic SQL**, host variables can also contain text for Embedded SQL statements.

Embedded SQL features

Embedded SQL provides several advantages over a call-level interface:

- Embedded SQL is easy to use because it is simply Transact-SQL with some added features that facilitate using it in an application.
- It is an ANSI/ISO-standard programming language.
- It requires less coding to achieve the same results as a call-level approach.
- Embedded SQL is essentially identical across different host languages. Programming conventions and syntax change very little. Therefore, to write applications in different languages, you need not learn new syntax.
- The precompiler can optimize execution time by generating stored procedures for the Embedded SQL statements.

Transact-SQL support in Embedded SQL

With the exception of print, raiserror, readtext, and writetext, all Transact-SQL statements, functions, and control-of-flow language are valid in Embedded SQL. You can develop an interactive prototype of your Embedded SQL application in Transact-SQL to facilitate debugging your application, then easily incorporate it into your application.

Most Adaptive Server Enterprise datatypes have an equivalent in Embedded SQL. Also, you can use host language datatypes in Embedded SQL. Many datatype conversions occur automatically when a host language datatype does not exactly match an Adaptive Server Enterprise datatype.

You can place host language variables in Embedded SQL statements wherever literal quotes are valid in Transact-SQL. Enclose the literal with either single (‘) or double (“) quotation marks. For information on delimiting literals that contain quotation marks, see the *Adaptive Server Enterprise Reference Manual*.

Embedded SQL has several features that Transact-SQL does not have:

- *Automatic datatype conversion* occurs between host language types and Adaptive Server Enterprise types.
- *Dynamic SQL* lets you define SQL statements at runtime.
- *SQLCA*, *SQLCODE*, and *SQLSTATE* lets you communicate between Adaptive Server Enterprise and the application program. The three entities contain error, warning, and informational message codes that Adaptive Server Enterprise generates.
- *Return code testing routines* detect error conditions during execution.

Getting started

Before attempting to run the precompiler, make sure that Client-Library version 12.5 or later is installed, since the precompiler uses it as the runtime library. Also, make sure Adaptive Server Enterprise version 12.5 or later is installed. If products are missing, contact your **System Administrator**.

Invoke the precompiler by issuing the appropriate **command** at the operating system prompt. See the *Open Client and Open Server Programmers Supplement* for details.

The precompiler command can include several flags that let you determine options for the precompiler, including the input file, login user name and password, invoking HA failover, and precompiler modes. The *Open Client and Open Server Programmers Supplement* contains operating system-specific information on precompiling, compiling, and linking your Embedded SQL application.

Using the examples

The examples in this guide use the pubs2 **database**. To run the examples, specify the pubs2 database with the Transact-SQL use statement.

This product is shipped with several online examples. For information on running these examples, see the *Open Client and Open Server Programmers Supplement*.

Backward compatibility

The precompiler is compatible with precompilers that are ANSI SQL-89-compliant. However, you may have applications created with earlier Embedded SQL versions that are not ANSI-compliant. This precompiler uses most of the same Embedded SQL statements used in previous precompiler versions, but it processes them differently.

To migrate applications created for earlier precompiler versions:

1 Remove the following SQL statements and keywords from the application, because System 11 and later does not support them:

- release *connection_name*
- recompile
- noparse
- noproc
- pcoptions sp_syntax
- cancel

release causes a precompiler error; the precompiler ignores the other keywords. The cancel statement causes a runtime error.

2 Use the precompiler to precompile the application again.

Creating and running an Embedded SQL program

Follow these steps to create and run your Embedded SQL application program:

1 Write the application program and include the Embedded SQL statements and variable declarations.

2 Save the application in a *.pco* file.

3 Precompile the application. If there are no severe errors, the precompiler generates a file containing your application program. The file has the same name as the original source file, with a different extension, depending on the requirements of your COBOL compiler. For details, see the *Open Client and Open Server Programmers Supplement*.

4 Compile the new source code as you would compile a standard COBOL program.

5 Link the compiled code, if necessary, with the required libraries.

6 If you specified the precompiler option to generate stored procedures, load them into Adaptive Server Enterprise by executing the generated script with isql.

7 Run the application program as you would any standard COBOL program.

How the precompiler processes your applications

The Embedded SQL precompiler translates Embedded SQL statements into COBOL data declarations and call statements. After precompiling, you can compile the resulting source program as you would any conventional COBOL program.

The precompiler processes your application in two passes. In the first pass, the precompiler *parses* the Embedded SQL statements and variable declarations, checking the syntax and displaying messages for any errors it detects. If the precompiler detects no severe errors, it proceeds with the second pass, wherein it does the following:

- Adds declarations for the precompiler variables, which begin with "SQL--". To prevent confusion, do not begin your variable names with "SQL".
- Converts the text of the original Embedded SQL statements to comments.
- Generates stored procedures and calls to stored procedures if you set this option in the precompile command line.
- Converts Embedded SQL statements to calls to runtime routines.

- Generates up to three files: a *target file*, an optional **listing file**, and an optional **isql script file**.

Note For detailed descriptions of precompiler command line options, see the *Open Client and Open Server Programmers Supplement*.

Multiple Embedded SQL source files

If the Embedded SQL application consists of more than one source file, the following statements apply:

- Connection names are unique and global to the entire application.
- Cursor names are unique for a given connection.
- Prepared statement names are global to the connection.
- Dynamic descriptors are global to the application.

Precompiler-generated files

The **target file** is similar to the original input file, except that all SQL statements are converted to runtime calls.

The listing file contains the input file and its source statements, plus any informational, warning, or error messages.

The isql script file contains the precompiler-generated stored procedures. The stored procedures are written in Transact-SQL.

Group element referencing

The Embedded SQL COBOL precompiler supports the COBOL language structure syntax for host variables in exec sql statements. For example, for a structure A containing structure B, which in turn contains a fundamental structure data item C, A.B.C is equivalent to C OF B OF A.

White spaces are allowed between the elements and the period (.). It is illegal to mix the two syntaxes, such as C OF A .B . Following is an example of group element referencing:

```
 EXEC SQL BEGIN DECLARE SECTION END-EXEC .

      01    AU-IDPIC X(15).
      01    GROUP1.
      05    GROUP2.
            10  LNAME PIC X(40).
            10  FNAME PIC X(40).
            10  PHONE PIC X(15).

EXEC SQL END DECLARE SECTION END-EXEC.
                     ...
EXEC SQL USE pubs2 END-EXEC.

MOVE "724-80-9391" TO AU-ID.
EXEC SQL SELECT INTO :GROUP1. GROUP2.LNAME,
                              :GROUP2.FNAME, :PHONE
                   au_lname, au_fname, phone
                   FROM authors
                   WHERE au_id = :AU-ID END-EXEC.
DISPLAY "LAST  NAME = ", LNAME.
DISPLAY "FIRST NAME = ", FNAME.
DISPLAY "PHONE #    = ", PHONE.

* This SELECT does the same thing. You can use
:GROUP1.GROUP2
* which refers to the entire structure, but partially
qualified
* names such as :LNAME OF GROUP1 do not work.

EXEC SQL SELECT INTO :GROUP1. GROUP2
             au_lname, au_fname, phone
                    FROM authors
                     WHERE au_id = :AU-ID END-EXEC.

DISPLAY "----------------------------------------".
DISPLAY "GROUP LISTING FROM ENTIRE STRUCTURES".
DISPLAY "----------------------------------------".
       DISPLAY "LAST  NAME = ", LNAME.
       DISPLAY "FIRST NAME = ", FNAME.
       DISPLAY "PHONE #    = ", PHONE.

                    ...
```

CHAPTER 2

General Information

This chapter provides general information about Embedded SQL.

Five tasks of an Embedded SQL program

In addition to containing the host language code, an Embedded SQL program performs five tasks. Each Embedded SQL program must perform all these tasks, to successfully precompile, compile, and execute. Subsequent chapters discuss these five tasks.

1 Establish SQL communication using SQLCA, SQLCODE, or SQLSTATE.

   Set up the SQL communication area (SQLCA, SQLCODE, or SQLSTATE) to provide a communication path between the application program and Adaptive Server Enterprise. These structures contain error, warning and information message codes that Adaptive Server Enterprise and Client-Library generate. See Chapter 3, “Communicating with Adaptive Server Enterprise.”

2 Declare Variables.

   Identify host variables used in Embedded SQL statements to the precompiler. See Chapter 4, “Using Variables.”

3 Connect to Adaptive Server Enterprise.

   Connect the application to Adaptive Server Enterprise. See Chapter 5, “Connecting to Adaptive Server Enterprise.”

4 Send Transact-SQL statements to Adaptive Server Enterprise.

Send Transact-SQL statements to Adaptive Server Enterprise to define and manipulate data. See Chapter 6, “Using Transact-SQL Statements.”

5 Handle errors and return codes.

Handle and report errors returned by Client-Library and Adaptive Server Enterprise using SQLCA, SQLCODE, or SQLSTATE. See Chapter 8, “Handling Errors.”

Simplified Embedded SQL program

Following is a simplified Embedded SQL program. At this point, you need not understand everything shown in the program. Its purpose is to demonstrate the parts of an Embedded SQL program. The details are explained in subsequent chapters.

```
 IDENTIFICATION DIVISION.
  PROGRAM-ID. EXAMPLE.
  ENVIRONMENT DIVISION.
  DATA DIVISION.
  WORKING-STORAGE SECTION.

  * Communicating with Adaptive Server Enterprise -
Chapter 3
       exec sql include sqlca end-exec.

  * Declaring variables  -  Chapter 4
  exec sql begin declare section end-exec
  01  MY-ID           PIC X(30).
  01  MYPASS          PIC X(30).
  01  MYSERVER        PIC X(30).
  exec sql end declare section end-exec.

  PROCEDURE DIVISION.
  MAIN-SECTION.
  PARA-1.

  * Initializing error-handling routines - Chapter 8

  exec sql whenever sqlerror perform ERR-PARA
  through ERR-PARA-END end-exec.
* Connecting to Adaptive Server Enterprise - Chapter 5

      DISPLAY "PLEASE ENTER USER-ID".
      ACCEPT MY-ID.
```

```
     DISPLAY "PLEASE ENTER PASSWORD".
     ACCEPT MYPASS.
     DISPLAY "SERVER TO USE?".
     ACCEPT MYSERVER.
     exec sql connect :MY-ID identified by :MYPASS
     using :MYSERVER end-exec.
*Issuing Transact-SQL statements  -  Chapter 6
 exec sql update alltypes set account = account * 2 end-
exec.
exec sql commit work end-exec.
*Closing connection to the server  -  Chapter 5

 exec sql disconnect default end-exec.
 STOP RUN.

Error-handling routine  -  Chapter 8

  ERR-PARA.
      DISPLAY     " ERROR CODE "    SQLCODE
        " ERROR MESSAGE: "          SQLERRMC.
  ERR-PARA-END.
END PROGRAM.
```

General rules for Embedded SQL

The following rules apply to Embedded SQL statements:

- Embedded SQL statements begin with these keywords:

  exec sql

- Embedded SQL requires continuation characters in column 7 and tokens from column 8 to column 72. Place exec sql at the beginning of the statement.
- The exec sql begin declare section statement must be aligned at the correct column for data declarations for the generated declaration section to be properly aligned, and to avoid compiler warnings.
- Embedded SQL keywords are not case sensitive. exec sql, EXEC SQL, Exec Sql, or any other of case mix is equally valid. This manual consistently shows Embedded SQL keywords in lowercase. For example:

  ```
  exec sql commit work end-exec.
  ```

- All Embedded SQL statements end with the keyword end-exec. Place a period after end-exec when your program's syntax or logic requires it. For example, the following code requires a period after end-exec because a COBOL paragraph must end with a period:

```
PARA-1.
     IF SQLCODE = 0
         exec sql commit work end-exec.
 PARA-2.
```

  In the next example, there is no period after the first end-exec because COBOL does not allow periods between if and else.

```
IF SQLCODE NOT = 0
   exec sql rollback transaction disconnect
   end-exec
 ELSE
   exec sql commit work end-exec.
```

- Embedded SQL statements can extend across several lines. end-exec must be at the end of the statement's last line or on a new line following the last line of code.

Statement placement

In general, an application program can have Embedded SQL statements wherever COBOL statements are valid. However, Embedded SQL statements cannot be made until the WORKING-STORAGE SECTION of a program's DATA DIVISION has been defined. Thus, the FILE SECTION, for example, cannot contain Embedded SQL statements.

Comments

Comments placed within Embedded SQL and COBOL statements must follow one of three conventions.

The Transact-SQL convention is:

```
/* comments */
```

The COBOL convention is:

* (in column 7)

The ANSI convention is:

```
-- comments
```

Comments placed outside SQL statements must conform to COBOL programming conventions.

Identifiers

Identifiers are used as procedure names or data names within your application. You cannot split identifiers across lines.

Quotation marks

Enclose literal character strings in Embedded SQL statements within single or double quotation marks. If a character string begins with a double quotation mark, end it with a double quotation mark. If a character string begins with a single quotation mark, end it with a single quotation mark.

Reserved words

Do not use COBOL, Transact-SQL, or Embedded SQL reserved words except as intended by the respective languages.

You can write Embedded SQL keywords in uppercase, lowercase, or mixed case. This guide shows Embedded SQL keywords in lowercase.

Variable naming conventions

Embedded SQL variables must conform to COBOL naming conventions. Do not place variable names within quotation marks. Applicable quotations marks are inserted automatically when the variable names are replaced with actual values. While parsing your application, the precompiler adds declarations for variables. These declarations begin “SQL--”. So, to avoid confusion, do not begin variable names with “SQL”.

Scoping rules

Embedded SQL and precompiler-generated statements adhere to host language scoping rules. The whenever statement and cursor names are exceptions.

Statement batches

As in Transact-SQL, you can batch several SQL statements in a single exec sql statement. Batches are useful and more efficient when an application executes a fixed set of Transact-SQL statements each time it runs.

For example, some applications create temporary tables and indexes when they start up. You could send these statements in a single batch. See the *Adaptive Server Enterprise Reference Manual* for rules about statement batches.

The following restrictions apply to statement batches:

- Statements in a batch cannot return results to the program. That is, a batch cannot contain select statements.
- All statements in a batch must be valid Transact-SQL statements. You cannot place Embedded SQL statements such as declare cursor and prepare in a statement batch.
- The same rules that apply to Transact-SQL batches apply to Embedded SQL batches. For example, you cannot put a use database statement in an Embedded SQL batch.

Embedded SQL constructs

Table 2-1 displays valid constructs in Embedded SQL statements:

Table 2-1: Embedded SQL constructs

begin declare section	drop trigger
begin tran	drop view
begin work	dump database
checkpoint	dump tran
close *cursor_name*	end declare section
commit tran	exec *procedure_name*
commit work	execute name
connect	execute immediate
create database	fetch *cursor_name*
create default	grant
create table	include sqlca or *file*
create index	insert
create unique index	open *cursor_name*
create clustered index	prepare *statement_name*
create nonclustered index	revoke
create unique clustered index	rollback tran
create unique nonclustered index	rollback work
create proc	select
create rule	set
create trigger	truncate
create view	update
declare cursor	use
delete	whenever *condition action*
disconnect	
drop table	
drop default	
drop index	
drop proc	
drop rule	

CHAPTER 3

Communicating with Adaptive Server Enterprise

This chapter explains how to enable an application program to receive status information from Adaptive Server Enterprise. The topics covered include:

To create a communication path and declare system variables to be used in communications from Adaptive Server Enterprise to the application, you must create one of the following entities:

- A SQL Communication Area (SQLCA), which includes SQLCODE
- A standalone SQLCODE long integer
- A SQLSTATE character **array**

SQLCODE, SQLCA, and SQLSTATE are system variables used in communication from Adaptive Server Enterprise to the application.

After Adaptive Server Enterprise executes each Embedded SQL statement, it stores return codes in SQLCA, SQLCODE, or SQLSTATE. An application program can access the variables to determine whether the statement succeeded or failed.

Note The precompiler automatically sets SQLCA, SQLCODE, and SQLSTATE variables, which are critical for runtime access to the database. You need not initialize or modify them.

For details on detecting and handling errors, multiple error messages, and other return codes, see Chapter 8, “Handling Errors.”

Scoping rules: SQLCA, SQLCODE, and SQLSTATE

You can declare SQLCA anywhere in the application program where a COBOL variable can be declared. The scope of the structure follows COBOL scoping rules.

If you declare SQLCA, SQLCODE, or SQLSTATE within your file, each variable must be in scope for all executable Embedded SQL statements in the file. The precompiler generates code to set each of these status variables for each Embedded SQL statement. So, if the variables are not in scope, the generated code will not compile.

Declaring SQLCA

Warning! Although SQLSTATE is preferred over SQLCODE and SQLCA, this version of the precompiler supports only SQLCODE. A future version will fully support both SQLCA and SQLSTATE.

Declare SQLCA in your application program's WORKING-STORAGE SECTION. The syntax for declaring SQLCA is:

```
exec sql include sqlca [is external] [is global]
    end-exec.
```

Multiple SQLCAs

Because a single file can contain multiple COBOL programs, you may have multiple SQLCAs. However, each SQLCA must be in a separate WORKING-STORAGE SECTION.

SQLCA variables

When the precompiler encounters the include sqlca statement, it inserts the SQLCA structure declaration into the application program. SQLCA is a data structure containing 26 precompiler-determined *system variables*, each of which can be accessed independently.

SQLCA variables pass information to your application program about the status of the most recently executed Embedded SQL statement.

Table 3-1 describes the SQLCA variables that hold status information, return codes, error codes, and error messages generated by Adaptive Server Enterprise:

Table 3-1: Adaptive Server Enterprise SQLCA variables

Variable	Datatype	Description
SQLCAID	PIC X(8)	Text string that contains "SQLCA".
SQLCABC	PIC S9(9) COMP	Length of SQLCA.
SQLCODE	PIC S9(9) COMP	Contains the return code of the most recently executed SQL statement. See the SQLCODE values in Table 3-2 on page 21 for return code definitions.
SQLWARN0 to *SQLWARN7*	PIC X(1)	Warning flags. Each flag indicates whether a warning has been issued: a "W" for warning, or a blank space for no warning. Chapter 8 describes the SQLWARN flags.
SQLERRMC	PIC X(256)	Error message.
SQLERRML	PIC S9(9) COMP	Error message length.
SQLERRP	PIC X(8)	Procedure that detected error/warning.
SQLERRD	PIC S9(9) COMP OCCURS 6 TIMES	Details of error/warning. SQLERRD(3) is number of rows affected.

Accessing SQLCA variables

The SQLCA variables listed in the previous section provide additional information about errors and return codes to help in debugging as well as in the normal processing of your application.

Warning! Do not define both a SQLCODE and a SQLCA as SQLCODE, as *SQLCODE* is a field within the SQLCA structure.

SQLCODE within SQLCA

The application should test SQLCODE after each statement executes, because Adaptive Server Enterprise updates it after each execution. As a rule, use the whenever statement, described in Chapter 8, "Handling Errors," to perform the SQLCODE test.

Following are examples of using SQLCODE:

```
IF SQLCODE = 100
 PERFORM END-DATA-PARA.
```

or

```
DISPLAY "SQL status code is" SQLCODE.
```

Declaring SQLCODE as a standalone area

Note Although SQLSTATE is preferred over SQLCODE and SQLCA, this version of the precompiler supports only SQLCODE. A future version will fully support both SQLCA and SQLSTATE.

As an alternative to creating a SQLCA, use SQLCODE independently. It contains the return code of the most recently executed SQL statement. The benefit of declaring SQLCODE as a standalone area is that it executes code faster. If you have no need to review the other information that SQLCA holds and are interested only in return codes, consider using SQLCODE.

Despite SQLCODE's faster execution speed, SQLSTATE is preferred over SQLCODE because SQLCODE is a deprecated feature that is compatible with earlier versions of Embedded SQL.

Warning! Do not declare SQLCODE within a *declare* section.

Following is an example of declaring SQLCODE as a standalone area:

```
01  SQLCODE S9(9)    COMP.
 exec sql open cursor pub_id   end-exec.

PARAGRAPH-1:
    exec sql fetch pub_id into :PUB_NAME  end-exec.
 IF SQLCODE = 0 GOTO PARAGRAPH-1.
```

For details on debugging any errors SQLCODE indicates, see Chapter 8, “Handling Errors.”

Table 3-2 displays SQLCODE values:

Table 3-2: SQLCODE values

Value	Description
0	Statement executed successfully.
-n	Error occurred. See Server-Library or Client-Library error messages. *-n* represents the number associated with the error or exception.
+100	No data exists, no rows left after fetch, or no rows met search condition for update, delete, or insert.

Using SQLSTATE

Warning! Although SQLSTATE is preferred over SQLCODE and SQLCA, this version of the precompiler supports only SQLCODE. A future version will fully support both SQLCA and SQLSTATE.

SQLSTATE is a status parameter. Its codes indicate the status of the most recently attempted statement—either the statement completed successfully or an error occurred during the execution of the statement.

The following example illustrates a declaration of SQLSTATE:

```
WORKING-STORAGE SECTION.
01 SQLSTATE PIC x(5)
 . . .
exec sql whenever sqlerror perform ERR-PARA
 end-exec
 . . .
ERR-PARA.
    IF  sqlstate = "ZD000" or
         sqlstate = "ZE000" or
         sqlstate = "ZF000" or
         sqlstate = "ZG000" or
         sqlstate = "ZH000"
         DISPLAY "Unexpected results were ignored"
     ELSE
        IF sqlstate = "08001" or sqlstate = "08000"
```

```
            DISPLAY "Connection failed-quitting"
            STOP RUN
        ELSE
            DISPLAY "A non-results, non-connect
            — error occurred"
        END_IF
    END_IF
```

Table 3-3 lists SQLSTATE values:

Table 3-3: SQLSTATE values

Value	Description
00XXX	Successful execution
01XXX	Warning
02XXX	No data exists; no rows affected
Any other value	Error

Obtaining SQLSTATE codes and error messages

SQLSTATE can contain a list of one or more error and/or warning messages. The messages can be informational, warning, severe, or fatal messages. Open Client Client-Library and Open Server Server Library generate the majority of SQLSTATE messages. See the appropriate documentation for a complete list of SQLSTATE codes and error messages.

See Appendix A, “Precompiler Warning and Error Messages,” for the table of SQLSTATE messages that the precompiler can generate.

CHAPTER 4

Using Variables

This chapter details the following two types of variables that pass data between your application and Adaptive Server Enterprise:

- Host variables, which are COBOL variables you use in Embedded SQL statements to hold data that is retrieved from and sent to Adaptive Server Enterprise
- Indicator variables, which you associate with host variables to indicate null data and data truncation

Declaring variables

As discussed in Chapter 3, “Communicating with Adaptive Server Enterprise,” the precompiler automatically sets the system variables when you include SQLCA, SQLCODE, or SQLSTATE in the application program. However, you must explicitly declare host and indicator variables in a declare section before using them in Embedded SQL statements.

Warning! The precompiler generates some variables, all of which begin with “SQL--”. Do not begin your variables with “SQL,” or you may receive an error message or unreliable data.

You cannot use COPY statements in a declare section. The syntax for a declare section is:

```
exec sql begin declare section end-exec
    declarations ...
exec sql end declare section end-exec.
```

Host variable declarations must conform to the COBOL rules for data declarations. You need not declare all variables in one declare section, since you can have an unlimited number of declare sections in a program.

Note Version 11.1 and later does not support updates to the PIC clause.

When declaring variables, you must also specify the picture and usage clauses. For valid picture and usage clauses, see the section "Comparing COBOL and Adaptive Server Enterprise datatypes" on page 35.

The following example shows a sample declare section:

```
exec sql begin declare section end-exec
 01  E-NAME      PIC X(30).
 01  E-TYPE      PIC X(3).
 01  TINY-INT    PIC S9(2) COMP.
 01  SHORT-INT   PIC S9(4) COMP.
 01  MONEY-DATA  CS-MONEY.
 exec sql end declare section end-exec.
```

Declaring a character array

The precompiler supports *complex definitions*, which are structures and arrays. You can nest structures, but you cannot have an array of structures.

The precompiler recognizes single-dimensional arrays of all datatypes. The precompiler also recognizes double-dimensional arrays of characters, as demonstrated in the following example:

```
01 NUMSALES PIC S9(9) OCCURS 25 TIMES.
exec sql begin declare section end-exec.
 01 DAYS-OF-THE-WEEK PIC X(31) OCCURS 7 TIMES.
 exec sql end declare section end-exec.
```

For details on arrays, see "Using arrays" on page 31.

Using host variables

Host variables let you transfer values between Adaptive Server Enterprise and the application program.

Declare the host variable within the application program's Embedded SQL declare section. Only then can you use the variable in SQL statements.

When you use the variable within an Embedded SQL statement, prefix the host variable with a colon. When you use the variable elsewhere in the program, do *not* use a colon. When you use several host variables successively in an Embedded SQL statement, separate them with commas or follow the grammar rules of the SQL statement.

The following example demonstrates correct host variable usage. *PAR-1*, *PAR-2*, and *PAR-3* are declared as host variables and are then used as parameters to the myproc procedure:

```
exec sql begin declare section end-exec
 01  PAR-1              PIC X(10).
 01  PAR-2              PIC X(10).
 01  PAR-3              PIC X(10).
 exec sql end declare section end-exec
 exec sql exec myproc :PAR-1, :PAR-2, :PAR-3 end-exec.
```

There are four ways to use host variables:

- Input variables for SQL statements and procedures
- Result variables
- Status variables from calls to SQL procedures
- Output variables for SQL statements and procedures

Regardless of their function, declare all host variables as described in "Declaring variables" on page 23. Following are instructions for using host variables.

Host input variables

These variables pass information to Adaptive Server Enterprise. The application program assigns values to them. They hold data used in executable statements such as stored procedures, select statements with where clauses, insert statements with values clauses, and update statements with set clauses.

The following example uses the *TITLE-ID1, TITLE-ID2*, and *PUB-ID* variables as input variables:

```
exec sql begin declare section end-exec
 01  TITLE-ID1       PIC X(6).
 01  TITLE-ID2       PIC X(6).
 01  PUB-ID          PIC X(4).
 exec sql end declare section end-exec

 exec sql delete from titles
      where title_id = :TITLE-ID1 end-exec.
 exec sql update titles set pub_id = :PUB-ID
      where title_id = :TITLE-ID2 end-exec.
```

Host result variables

These variables receive the results of select and fetch statements.

The following example uses the *TITLE-ID* variable as a result variable:

```
exec sql begin declare section end-exec
 01  TITLE-ID           PIC X(6).
 exec sql end declare section end-exec

 exec sql select title_id into :TITLE-ID from titles
      where pub_id = "0736"
      and type = "business" end-exec.
```

Host status variables

These variables receive the return status values of stored procedures. Status variables indicate whether the stored procedure completed successfully or the reasons it failed. You must use a variable that can be converted from the Adaptive Server Enterprise type to smallint.

The following example uses the *RET-CODE* variable as a **status variable**:

```
exec sql begin declare section end-exec
 01  RET-CODE   PIC S9(4) COMP.
 exec sql end declare section end-exec.
        . . .
 exec sql exec :RET-CODE = update_pubs end-exec.
 IF RET-CODE NOT = 0
 exec sql rollback transaction end-exec.
```

Host output variables

These variables pass data from stored procedures to the application program. Use host output variables when stored procedures return the value of parameters declared as out. See "Using stored procedures" on page 61.

The following example uses the *PAR1* and *PAR2* variables as output variables:

```
exec sql exec a_proc :PAR1 out, :PAR2 out end-exec.
```

Using indicator variables

You can associate indicator variables with host variables to indicate when a database value is null. Use a space and, optionally, the indicator keyword to separate each **indicator variable** from the host variable with which it is associated. Each indicator variable must immediately follow its host variable.

Without indicator variables, Embedded SQL cannot indicate null values.

Indicator variables and server restrictions

Embedded SQL is a generic interface that can run on a variety of servers, including Adaptive Server Enterprise.

Because it is generic, Embedded SQL does not enforce or reflect any particular server's restrictions. For example, Embedded SQL allows text and image stored procedure parameters, but Adaptive Server Enterprise does not.

When writing an Embedded SQL application, keep the application's ultimate target server in mind. If you are unsure about what is legal on a server and what is not, consult your server documentation.

Using host variables with indicator variables

Declare host and indicator variables in a declare section before using them anywhere in an application program containing Embedded SQL statements.

You must declare indicator variables as one of the following in a declare section:

PIC S9(4) COMP
DISPLAY SIGN LEADING *(and, optionally,* SEPARATE*)*
DISPLAY SIGN TRAILING *(and, optionally,* SEPARATE*)*
COMP-3
COMP-4
COMP-5
BINARY

Prefix indicator variables with a colon when using them in an Embedded SQL statement. The syntax for associating an indicator variable with a host variable is:

```
:host_variable [[indicator] :indicator_variable]
```

The association between an indicator and host variable lasts only for the duration of one exec sql statement.

Adaptive Server Enterprise sets the indicator variable only when you assign a value to the host variable. Therefore, you can declare an indicator variable once and reuse it with different host variables in different statements.

You can use indicator variables with output, result, and input variables. When used with output and result variables, Embedded SQL sets the variable to indicate the null status of the associated host variable. When used with input variables, you set the value of the indicator variable to show the null status of the **input variable** before submitting it to Adaptive Server Enterprise.

Note You can use indicator variables with output, result, and input variables.

Using indicator variables with host output and result variables

When you associate an indicator variable with an output or **result variable**, Client-Library automatically sets it to one of the following values in Table 4-1:

Table 4-1: Indicator variable values used with output or result variable

Value	Meaning
-1	The corresponding database column in Adaptive Server Enterprise contains a null value.
0	A non-null value was assigned to the host variable.
>0	An overflow occurred while data was being converted for the host variable. The host variable contains truncated data. The positive number represents the length, in bytes, of the value before it was truncated.

The following example demonstrates associating the *INDIC-V* indicator variable with the *PUB-NAME* result variable:

```
exec sql begin declare section end-exec
  01  INDIC-V     PIC S9(4) COMP.
  01  PUB-ID      PIC X(4).
  01  PUB-NAME    PIC X(20).
 exec sql end declare section end-exec

    exec sql select pub_name into :PUB-NAME :INDIC-V
         from publishers where pub_id = :PUB-ID
             end-exec.

     if INDIC-V = -1
         display "No Publisher name"
     else
         display "Publisher Name is: " PUB-NAME.
```

Using indicator variables with host input variables

When you associate an indicator variable with an input variable, you must explicitly set the indicator variable, using the values in Table 4-2 as a guide.

Table 4-2: Indicator variable values used with input variable

Value	Meaning
-1	Treat the corresponding input as a null value.
0	Assign the value of the host variable to the column.

You must supply host language code to test for a null input value and set the indicator variable to -1. This informs Client-Library of a null value. When you set the indicator variable to -1, null is used regardless of the host variable's actual value.

The following example demonstrates associating an indicator variable with an input variable. The database royalty column will be set to a null value because *R-INDIC* is set to -1. Changing the value of *R-INDIC* changes the value of royalty.

```
exec sql begin declare section end-exec
 01   R-INDIC   PIC S9(4) COMP.
 01   R-VAR     PIC X(10).
 exec sql end declare section end-exec.

     MOVE -1 TO R-INDIC.
     exec sql update titles
             set royalty = :R-VAR :R-INDIC
         where pub_id="0736" end-exec.
```

Host variable conventions

A host variable name must conform to COBOL naming conventions.

You can use a host variable in an Embedded SQL statement only if a Transact-SQL literal can be used in a Transact-SQL statement at the same location.

A host variable must conform to the valid precompiler datatypes. The datatype of a host variable must be compatible with the datatype of the database column values that are returned. See Table 4-3 on page 37 and Table 4-4 on page 38 for details.

Do not use host language reserved words and Embedded SQL keywords as variable names.

A host variable cannot represent Embedded SQL keywords or database objects, except as specified in dynamic SQL. See Chapter 4, “Using Variables.”

When a host variable represents a character string in a SQL statement, do not place it within quotes.

The following example is invalid because the precompiler inserts quotes around values when necessary. You should not type the quotes.

```
exec sql select pub_id from publishers
     where pub_id like ":PUB-ID"

end-exec
```

The following example is valid:

```
exec sql select pub_id from publishers
```

```
     where pub_id like :PUB-ID
end-exec
```

Using arrays

An array is a group of related pieces of data associated with one variable. You can use arrays as output variables for the into clause of select and fetch statements. For example:

```
01 author-array.
 10 author-name    PIC X(30)   occurs 100 times.
exec sql
 select au_lname
 from authors
 into :au_array
end-exec.
```

Note You can fetch a single item anywhere into an array. However, you can fetch multiple rows only into the beginning of an array.

For details on using arrays with select and fetch into, see “Selecting multiple rows through arrays” on page 47 in Chapter 6.

Multiple arrays

When you use multiple arrays within a single SQL statement, they must be the same size. Otherwise, you will receive an error message.

Scoping rules

The precompiler supports nested COBOL programs and COBOL’s rules for variable scoping. Host variables can use the is global and is external clauses. Following is a nested example:

```
IDENTIFICATION DIVISION.
 PROGRAM-ID.  outer.
 ENVIRONMENT DIVISION.
```

```
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.  xyz.
 OBJECT-COMPUTER.  xyz.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
    exec sql begin declare section end-exec.
     01 global-var is global pic x(10).
     01 not-global-var pic x(10).
     01 shared-var is external pic x(10).
     exec sql end declare section end-exec.
procedure division.
 p0.
     . . .
IDENTIFICATION DIVISION.
 PROGRAM-ID.  inner.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.  xyz.
 OBJECT-COMPUTER.  xyz.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
procedure division.
p0.
       . . .
* This is legal because global-var was
 * declared using is global
    exec sql
         select au_lname into :global-var
             where au_id = "998-72-3567"
    end-exec.
* This is not legal because not-global-var was
  * not declared using is global
    exec sql
         select au_lname into :not-global-var
             where au_id = "998-72-3567"
     end-exec.
       . . .
end program inner.
end program outer.
IDENTIFICATION DIVISION.
 PROGRAM-ID.  nonest.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER.  xyz.
 OBJECT-COMPUTER.  xyz.
 DATA DIVISION.
```

```
 WORKING-STORAGE SECTION.
    exec sql begin declare section end-exec.
         01 local-var pic x(10).
         01 shared-var is external pic x(10).
     exec sql end declare section end-exec.
procedure division.
p0.
        . . .
* This is legal.
     exec sql
         select au_lname into :local-var
         where au_id = "998-72-3567"
     end-exec.
* So is this.
    exec sql
         select au_lname into :shared-var
         where au_id = "998-72-3567"
     end-exec.
    . . .

end program nonest.
```

Datatypes

The COBOL *veneer layer* is a library used by the precompiled application along with Open Client Client-Library. The COBOL code generated by the precompiler calls functions in the veneer layer, each of which calls a specific Client-Library function. The veneer layer performs conversions and other operations that make it possible for COBOL to communicate with Client-Library. The veneer layer also provides conversions that translate between COBOL host variables and Adaptive Server Enterprise datatypes.

There are two types of ESQL/COBOL veneer layers: static and shared dynamic. The following table lists the shared dynamic veneer layer libraries that are released on all 32-bit and 64-bit platforms:

Platform	Library name	Reentrant version
HP-UX PA-RISC 32-bit	*libsybcobct.sl*	*libsybcobct_r.sl*
HP-UX PA-RISC 64-bit	*libsybcobct64.sl*	*libsybcobct_r64.sl*
All other 32-bit platforms that support ESQL/COBOL	*libsybcobct.so*	*libsybcobct_r.so*

Platform	Library name	Reentrant version
All other 64-bit platforms that support ESQL/COBOL	*libsybcobct64.so*	*libsybcobct_r64.so*

The existing static version of the ESQL/COBOL veneer layer library is called *libsybcobct.a*.

There are two types of data items: elementary and group data items. The following subsections describe these types of data items.

Elementary data items

An *elementary data item* is a complete item that cannot be broken into separate parts. You can use elementary data items as host variables.

Following is an example of an elementary data item:

```
01   MYSTR  PIC X(26).
```

You can use *MYSTR* as a host variable (*:MYSTR*) because it is an elementary data item.

Group data items

When multiple elementary data items combine to form a group of related items they become a *group data item*. You can use group data items as host variables. Declare group data items in declare sections.

Following is an example of a group item:

```
01 AUTH-REC.
10 AUTH-NAME                      PIC X(25).
10 STATE                          PIC X(25).
10 TOTAL-SALES PIC S9(9) COMP SYNC
```

Following is an example of selecting into a group item whose data items are host variables:

```
exec sql select au_lname, salary, tot_sales
 from table into :AUTH-REC end-exec
```

The preceding example has the same effect as the following code:

```
exec sql select au_lname, salary, tot_sales
 from table into :AUTH-NAME, :SALARY, :TOTAL-SALES
```

Another equivalent example is:

```
exec sql select au_lname, salary, tot_sales
 from table into :AUTH-NAME OF AUTH-REC,
 :SALARY OF AUTH-REC, :TOTAL-SALES OF AUTH-REC
```

Embedded SQL/COBOL also supports C language structure syntax for host variables in exec sql statements. For example, the preceding example could be rewritten as follows:

```
exec sql select au_lname, salary, tot_sales
 from table into :AUTH-REC.AUTH-NAME,
 :AUTH-REC.SALARY, :AUTH-REC.TOTAL-SALES
```

Use SYNC with COMP, COMP-4, COMP-5, and BINARY data items declared within group data items.

Special data items

Special Sybase datatypes, such as CS_MONEY, CS-TEXT, and CS-IMAGE are declared as shown in the following example:

```
01 MYTEXT PIC x(100) USAGE IS CS-TEXT.
```

Comparing COBOL and Adaptive Server Enterprise datatypes

Host variable datatypes must be compatible with the datatypes of the corresponding database columns. So, before writing your application program, check the datatypes of the database columns.

The following rules apply to datatypes:

- When you use any of the host variables in the “To: COBOL Datatype” column as input or output, the appropriate conversions occur automatically.
- Indicator variables must be of usage COMP, COMP-3, COMP-4, COMP-5, BINARY, or a variant of DISPLAY. They must have a picture string of S9(4) or equivalent.
- You can use any value with PIC S9(1-9) COMP. If decimal truncation occurs, no truncation message results. Instead, a SQLCA or SQLSTATE error message results, which specifically indicates digital truncation.

For example, if you select the value “1234” into a PIC S9(4), no truncation message occurs because the value fits in the given bytes. However, if you select “1234567” into PIC S9(3), a truncation message results because the value does not fit in the given bytes.

Converting datatypes

The precompiler automatically compares the datatypes of host variables with the datatypes of table columns in Adaptive Server Enterprise. If the Adaptive Server Enterprise datatype and the host language datatype are compatible but not identical, the COBOL veneer layer converts one type to the other. Datatypes are compatible if the precompiler can convert the data from one type to the other. If the datatypes are incompatible, a conversion error occurs at runtime and SQLCODE or SQLSTATE is set to a negative number.

Be careful when converting a longer datatype into a shorter one, such as a long integer into PIC S9(4) COMP, because there is always a possibility of truncating data. If a truncation occurs, SQLWARN1 is set.

Note Do not fetch Adaptive Server Enterprise data into COBOL numeric fields that contain editing characters such as commas and decimal characters. Instead, fetch the data into an unedited field such as comp or display sign leading separate and then move the data into an edited field.

Converting datatypes for result variables

Table 4-3 shows which data conversions are valid for result variables. A bullet indicates that conversion is possible, but be aware that certain types of errors can result if you are not careful when choosing host variable datatypes.

Table 4-3: Datatype conversions for result variables

From: Adaptive Server Enterprise datatype	To: COBOL datatype				
	S9(1—9) COMP, COMP-4, COMP-5, BINARY	CS-DATE, CS-TIME, CS-DATETIME, CS-DATETIME4	PIC X(n)	S9(m)V9(n) DSLS, DSL, DSTS, DST, COMP, COMP-3	CS-MONEY, CS-MONEY4
char	•	•	•	•	•
varchar	•	•	•	•	•
bit	•		•	•	
tinyint	•		•	•	•
smallint	•		•	•	•
int	•		•	•	•
bigint	•		•	•	•
ubigint	•		•	•	•
uint	•		•	•	•
usmallint	•		•	•	•
float	•		•	•	•
money	•		•	•	•
money4	•		•	•	•
numeric	•		•	•	•
real	•		•	•	•
date		•			
time		•			
datetime		•	•		
datetime4		•	•		

Key: DSL = Display Sign Leading
DSLS = Display Sign Leading Separate
DST = Display Sign Trailing
DSTS = Display Sign Trailing Separate

Converting datatypes for input variables

Table 4-4 shows which data conversions are valid for input variables. A bullet indicates that conversion is possible. Errors, including truncation, can result if you choose nonconvertible host variable datatypes.

Table 4-4: Datatype conversions for input variables

From: COBOL datatype	To: Adaptive Server Enterprise datatype												
	varchar	money	date, time,	int, smallint,	bigint	ubigint	uint	usmallint	bit	float	char	numeric	real, float
S9(1—9) COMP, COMP-4, COMP-5, BINARY		•		•	•	•	•	•		•		•	•
CS-DATE, CS-TIME, CS-DATETIME, CS-DATETIME4			•										
PIC X(n)	•		•								•		
S9(m)V9(n) DSLS, DSL, DSTS, DST, COMP-3		•		•	•	•	•	•	•	•		•	•
CS-MONEY, CS-MONEY4	•	•		•	•	•	•	•	•	•	•	•	•

Key: DSL = Display Sign Leading
DSLS = Display Sign Leading Separate
DST = Display Sign Trailing
DSTS = Display Sign Trailing Separate

CHAPTER 5

Connecting to Adaptive Server Enterprise

This chapter explains how to connect an Embedded SQL program to Adaptive Server Enterprise and describes how to specify servers, user names, and passwords. Topics include:

Connecting to a server

Use the connect statement to establish a connection between an application program and Adaptive Server Enterprise. If an application uses both C and COBOL languages, the first connect statement must be issued from a COBOL program.

The syntax for the connect statement is:

```
exec sql connect :user [identified by :password]
 [at :connection_name] [using :server]
 [label_name label_name label_value label_value...]
 end-exec
```

Each of the following sections describes one of the connect statement's arguments. Only the *user* argument is required for the connect statement. The other arguments are optional.

user

user is a host variable or quoted string that represents a Adaptive Server Enterprise user name. The user name must be valid for the server specified.

password

password is a host variable or quoted string that represents the password associated with the specified user name. This argument is necessary only if a password is required to access Adaptive Server Enterprise. If the password argument is null, the user does not need to supply a password.

connection_name

connection_name uniquely identifies the Adaptive Server Enterprise connection. It can be a double-quoted or an unquoted literal. You can create an unlimited number of connections in an application program, one of which can be unnamed. *connection_name* has a maximum size of 255 characters.

When you use *connection_name* in a connect statement, all subsequent Embedded SQL statements that specify the same connection automatically use the server indicated in the connect statement. If the connect statement specifies no server, the **default** server is used. See the *Open Client and Open Server Programmers Supplement* for details on how the default server is determined.

Note To change the current server connection, use the set connection statement described in “Changing the current connection” on page 41.

An Embedded SQL statement should reference only a *connection_name* specified in a connect statement. At least one connect statement is required for each server that the application program uses.

server

server is a host variable or quoted string that represents a server name. *server* must be a character string that uniquely and completely identifies a server.

connect example

The following example uses the UNIX format to connect to the server SYBASE.

```
exec sql begin declare section end-exec
01      USER       PIC X(16)   VALUE "myname"
01      PASSWD     PIC X(16)   VALUE "abcdefg".
01      SERV-NAME  PIC X(16).
01      MY-SERVER  PIC X(512).
exec sql end declare section end-exec.
    MOVE "SYBASE" TO SERV-NAME.
exec sql connect :USER identified by :PASSWD
     using :SERV-NAME end-exec.
```

Changing the current connection

Use the set connection statement to change the current connection. The statement's syntax is:

```
exec sql set connection {connection_name | default}
```

where "default" is the unnamed connection, if any.

The following example changes the current connection:

```
exec sql connect "ME" at connect1 using "SERVER1" end-
exec
exec sql connect "ME" at connect2 using "SERVER2" end-
exec
exec sql set connection connect1 end-exec
exec-sql select user_id()into :MYID end-exec
```

Establishing multiple connections

Some Embedded SQL applications require or benefit from having more than one active Adaptive Server Enterprise connection. For example:

- An application that requires multiple Adaptive Server Enterprise login names can have a connection for each login account name.

- By connecting to more than one server, an application can simultaneously access data stored on different servers.

A single application can have multiple connections to a single server or multiple connections to different servers. Use the connect statement's at *connection_name* clause to name additional connections for an application.

If you open one connection and then another new named or unnamed connection, the new connection is the current connection.

Note If you are creating stored procedures with the precompiler for appropriate SQL statements with the precompiler, then for each Embedded SQL file, the precompiler generates a single file for all stored procedures on all servers. You can load this file into the appropriate server(s). Although the server(s) will report warnings and errors about being unable to read the procedures intended for other servers, ignore them. The stored procedures appropriate for each server will load properly on that server. Be sure to load the stored procedures on all applicable servers or your queries fail.

Naming a connection

Table 5-1 shows how a connection is named:

Table 5-1: How a connection is named

If this clause is used	Without this clause	The connection name is
at *connection_name*		*connection_name*
using *server_name*	at	*server_name*
None		The actual name of the connection "DEFAULT"

Invalid statements with the at clause

The following statements are invalid with the at clause:

- connect
- begin declare section
- end declare section
- include file

- include sqlca
- set connection
- whenever

Using Adaptive Server Enterprise connections

Specify a connection name for any Embedded SQL statement that you want to execute on a connection other than the default unnamed connection. If your application program uses only one connection, you can leave the connection unnamed and omit the at clause.

The syntax for using multiple connections is:

```
exec sql [at connection_name] sql_statement
     end-exec
```

where *sql_statement* is a Transact-SQL statement.

The following example shows how two connections can be established to different servers and used in consecutive statements:

```
exec sql begin declare section end-exec
 01  USER            PIC X(16) VALUE "myname".
 01  PASSWD          PIC X(16) VALUE "mypass".
 01  AU-NAME         PIC X(20).
 01  A-VALUE         PIC S9(9) COMP.
 01  A-TEST          PIC S9(9) COMP.
 01  SERVER-1        PIC X(16).
 01  SERVER-2        PIC X(16).
 exec sql end declare section end-exec.
      . . .
      MOVE "sybase1" TO SERVER-1.
      MOVE "sybase2" TO SERVER-2.

      exec sql connect :USER identified by :PASSWD
         using :SERVER-1 end-exec.
      exec sql connect :USER identified by :PASSWD
         at connection-2 using :SERVER-2 end-exec.

 * This statement uses the current connection
 * (connection-2)
     exec sql select royalty into :A-VALUE from pubs
           where author = :AU-NAME end-exec.

 * This statement uses connection "SERVER-1"
```

```
IF A-VALUE = A-TEST
exec sql at SERVER-1 update titles
     set column = :A-VALUE * 2
     where author = :AU-NAME end-exec.
```

Disconnecting from a server

The connections your application program establishes remain open until you explicitly close them or until your program terminates. Use the disconnect statement to close a connection between the application program and Adaptive Server Enterprise.

The statement's syntax is as follows:

```
exec sql disconnect {connection_name | current |
     default | all} end-exec
```

where:

- current specifies the current connection.
- default specifies the unnamed default connection.
- all specifies all connections currently open.

The disconnect statement:

1 Rolls back the transaction, ignoring any established savepoints.

2 Closes the connection.

3 Drops all temporary objects, such as tables.

4 Closes all open cursors.

5 Releases locks established for the current transactions.

6 Terminates access to the server's databases.

disconnect does not implicitly commit current transactions.

Warning! Before the program exits, make sure you perform an exec sql disconnect or exec sql disconnect all statement for each open connection. In some configurations, Adaptive Server Enterprise may not be notified when a client exits without disconnecting. If this happens, resources held by the application will not be released.

CHAPTER 6

Using Transact-SQL Statements

This chapter explains how to use Transact-SQL statements with Embedded SQL and host variables. It also explains how to use *stored procedures*, which are collections of SQL statements stored in Adaptive Server Enterprise. Since stored procedures are compiled and saved in the database, they execute quickly without being recompiled each time you invoke them.

Transact-SQL statements in Embedded SQL

exec sql syntax

Embedded SQL statements must begin with the keywords exec sql and end with the keyword end-exec. The syntax for Embedded SQL statements is:

```
exec sql [at connection_name] sql_statement end-exec
```

where:

- *connection_name* specifies the connection for the statement. See Chapter 5, “Connecting to Adaptive Server Enterprise,” for a description of connections. The at keyword is valid for Transact-SQL statements and the disconnect statement.
- *sql_statement* is one or more Transact-SQL statements.

Invalid statements

Except for the following Transact-SQL statements, all Transact-SQL statements are valid in Embedded SQL:

- print
- raiserror
- readtext
- writetext

Transact-SQL statements that differ in Embedded SQL

While most Transact-SQL statements retain their functionality and syntax when used in Embedded SQL, the select, update, and delete statements (the Data Manipulation Language, or DML, statements) can be slightly different in Embedded SQL:

- The following four items are specific to the into clause of the select statement.
  - The into clause can assign one row of data to scalar host variables. This clause is valid only for select statements that return just one row of data. If you select multiple rows, a negative SQLCODE results, and only the first row is returned.
  - If the variables in an into clause are arrays, you can select multiple rows. If you select more rows than the array holds, an exception of SQLCODE <0 is raised, and the extra rows are lost.
  - select cannot return multiple rows of data in host variables, except through a cursor or by selecting into an array.
  - The update and delete statements can use the search condition where current of *cursor_name*.

Selecting rows

There can be a maximum of 1024 columns in a select statement. For the complete listing of the select statement's syntax, see the *Adaptive Server Enterprise Reference Manual*.

Selecting one row

When you use the select statement without a cursor or array, it can return only one row of data. Embedded SQL requires a cursor or an array to return more than one row of data.

In Embedded SQL, a select statement must have an into clause. The clause specifies a list of host variables to be assigned values.

Note The current Embedded SQL precompiler version does not support into clauses that specify tables.

The syntax of the Embedded SQL select statement is:

```
exec sql [at connect_name]
     select [all | distinct] select_list into
     :host_variable[[indicator]:indicator_variable]
     [, :host_variable
     [[indicator]:indicator_variable]...]
 end-exec
```

For additional information on select statement clauses, see the *Adaptive Server Enterprise Reference Manual*.

The following select statement example accesses the authors table in the pubs2 database and assigns the value of *au_id* to the host variable *ID*:

```
exec sql select au_id into :ID from authors
     where au_lname = "Stringer"
 end-exec
```

Selecting multiple rows through arrays

You can return multiple rows with arrays. The two array actions involve selecting and fetching into arrays.

select into arrays

Use the select into array method when you know the maximum number of rows that will be returned. If a select into statement attempts to return more rows than the array can hold, the statement returns the maximum number of rows that the smallest array can hold.

Following is an example of selecting into an array:

```
exec sql begin declare section end-exec
 01 TITLEID-ARRAY PIC X(6) OCCURS 100 TIMES.
 exec sql end declare section end-exec
 ...
 exec sql select title_id into :titleid-array
     from titles end-exec.
```

Indicator arrays

To use indicators with array fetches, declare an array of indicators of the same length as the *host_variable* array, and use the syntax for associating the indicator with the host variable.

Example

```
exec sql begin declare section end-exec
 01 ITEM-NUMBERS S9(9) OCCURS 100 TIMES.
 01 I-ITEM-NUMBERS S9(4) OCCURS 100 TIMES.
 exec sql end declare section end-exec
 ...
 exec sql select it_n from item.info
     into :item-numbers :i-item-numbers end-exec.
 ...
```

Arrays and structures as indicator variables

For tables with a large number of columns, you can use arrays and structures as a set of host variables that is referenced in a SQL statement. For this feature to work correctly, you must declare the indicator array or indicator structure elements with a PIC S9(4) clause and a COMP-5 clause. As with ESQL/C, use of structures and arrays as indicator variables removes the time consuming process of coding singleton indicator variables in ESQL/COBOL for every nullable column of every Embedded SQL statement in the application.

Examples

Example 1 This is an example of declaring indicator arrays and executing a query on the indicator arrays:

```
* Declare variables
....
01 HOST-STRUCTURE-M1.
   03 M-TITLE PIC X(64).
   03 M-NOTES PIC X(200).
   03 M-PUBNAME PIC X(40).
   03 M-PUBCITY PIC X(20).
   03 M-PUBSTATE PIC X(2).

01 INDICATOR-TABLE.
   03 I-NOTES-ARR PIC S9(4) COMP-5 OCCURS 5 TIMES.
```

```
....


* Execute query
....
EXEC SQL
SELECT substring(title, 1, 64), notes, pub_name,
            city, state
     INTO :HOST-STRUCTURE-M1:I-NOTES-ARR
     FROM titles, publishers
     WHERE titles.pub_id = publishers.pub_id
     AND title_id = :USER-TITLEID
END-EXEC.
....
```

Example 2 This is an example declaring indicator structures and executing a query on the indicator structures:

```
* Declare variables
....
01 HOST-STRUCTURE-M1.
   03 M-TITLE PIC X(64).
   03 M-NOTES PIC X(200).
   03 M-PUBNAME PIC X(40).
   03 M-PUBCITY PIC X(20).
   03 M-PUBSTATE PIC X(2).

01 INDICATOR-STRUCTURE-I1.
   03 I-TITLE PIC S9(4) COMP-5.
   03 I-NOTES PIC S9(4) COMP-5.
   03 I-PUBNAME PIC S9(4) COMP-5.
   03 I-PUBCITY PIC S9(4) COMP-5.
   03 I-PUBSTATE PIC S9(4) COMP-5.
....

* Execute query
....
EXEC SQL
SELECT substring(title, 1, 64), notes, pub_name, city,
       state
    INTO :HOST-STRUCTURE-M1:INDICATOR-STRUCTURE-I1
    FROM titles, publishers
    WHERE titles.pub_id = publishers.pub_id
    AND title_id = :USER-TITLEID
END-EXEC.
```

Usage

When using structs and arrays as indicator variables:

- The number of elements in the indicator array or struct must be exactly the same as the number of elements in the host variable structure. A mismatch causes cobpre or cobpre64 to stop processing, and code is not generated.
- The columns in the SELECT list must match by sequence, and datatype, the chosen structure name in the INTO list. A mismatch causes ct_bind() runtime errors and stops processing.

Error messages

Table 6-1 describes the Embedded SQL internal error messages created to handle host variable versus indicator variable mismatch errors for this feature.

Table 6-1: New internal error messages

Message ID	Message text	Severity	Fix
M_INVTYPE_V	Incorrect type of indicator variable found in the structure.	Fatal	Make sure that the same indicator variable is used in the hostvar and indicator declarations.
M_INVTYPE_VI	Mismatch between number of structure elements in the indicator structure and hostvar structure.	Fatal	Declare the same number of elements in the indicator structure and hostvar structure.
M_INVTYPE_VII	Mismatch between number of elements in the indicator array and hostvar structure.	Fatal	Declare the same number of elements in the indicator array and hostvar structure.

Limitation

You cannot mix singleton host variables or singleton indicator variables with hostvar structures, and indicator arrays or structures.

fetch into: batch arrays

fetch returns the specified number of rows from the currently active set. Each fetch returns the subsequent batch of rows. For example, if the currently active set has 150 rows and you select and fetch 60 rows, the first fetch returns the first 60 rows. The next fetch returns the following 60 rows. The third fetch returns the last 30 rows.

Note To find the total number of rows fetched, see the *SQLERRD* variable in the SQLCA, as described in “SQLCA variables” on page 18.

Following is an example of selecting into an array:

```
exec sql begin declare section end-exec
     TITLEID-ARRAY PIC X(6) occurs 100 times.
exec sql end declare section end-exec
...
exec sql
```

```
select title_id into :titleid_array
             from titles
end-exec
IF (SQLERRD OF SQLCA LESS THAN 50)
     DISPLAY "No of title_ids is less than 50");
ENDIF.
```

Cursors and arrays

Use the fetch into array method when you do not know the number of rows to be returned into the array. Declare and open a cursor, then use fetch to retrieve *groups of rows*. If a fetch into attempts to return more rows than the array can hold, the statement returns the maximum number of rows that the smallest array can hold and SQLCODE displays a negative value, indicating that an error or exception occurred.

Using cursors

A cursor is a data selector that passes multiple rows of data to the host program, one row at a time. The cursor indicates the first row, also called the **current row**, of data and passes it to the host program. With the next fetch statement, the cursor advances to the next row, which has now become the current row. This continues until all requested rows are passed to the host program.

Use a cursor when a select statement returns more than one row of data. Client-Library tracks the rows Adaptive Server Enterprise returns and buffers them for the application. To retrieve data with a cursor, use the fetch statement.

The cursor mechanism is composed of these statements:

- declare
- open
- fetch
- update and delete where current of
- close

Cursor scoping rules

The scope of a cursor declaration is the file in which it is declared. The open statement(s) for a cursor must reside in the same file in which the cursor is declared. Once a cursor is open, its scope is the connection on which it was opened.

The same cursor name can be opened for multiple connections. Cursor fetch, update, delete, and close operations can occur in files other than the one in which the cursor was declared, as long as they are executed on the same connection on which the cursor was opened.

Cursor names must be unique within a program. If, at runtime, an application attempts to declare two identically named cursors, the application fails with the following error message:

```
There is already another cursor with the name 'XXX'.
```

Declaring cursors

The declare cursor statement is a declaration, not an executable statement. Therefore, it may appear anywhere in a file; SQLCODE, SQLSTATE, and SQLCA are not set after this statement.

Declare a cursor for each select statement that returns multiple rows of data. You must declare the cursor before using it, and you cannot declare it within a declare section.

The basic syntax for declaring a cursor is:

```
exec sql declare cursor_name cursor
     for select_statement end-exec.
```

where:

- *cursor_name* identifies the cursor. The name must be unique and have a maximum of 255 characters. The name must begin with a letter of the alphabet or with the symbols # or _.
- *select_statement* is a select statement that can return multiple rows of data. The syntax for select is the same as described in the *Adaptive Server Enterprise Reference Manual*, except that you cannot use into or compute clauses.

Example: Declaring a cursor

The following example demonstrates declaring cursors:

```
exec sql declare C1 cursor for
 select type, price from titles
 where type like :WK-TYPE end-exec
```

In this example, C1 is declared as a cursor for the rows that will be returned for the type and price columns. The precompiler generates no code for the declare cursor statement. It simply stores the select statement associated with the cursor.

When the cursor opens, the select statement or procedure in the declare cursor statement executes. When the data is fetched, the results are copied to the host variables.

Note Each cursor's open and declare statements must be in the same file. Host variables used within the declare statement must have the same scope as the one in which the open statement is defined. However, once the cursor is open, you can perform fetch and update/delete where current of on the cursor in any file.

Declaring scrollable cursors

The syntax for declaring a scrollable cursor is:

```
exec sql declare  cursor_name  [cursor sensitivity]
[cursor scrollability] cursor
     for  select_statement ;
```

where:

- *cursor_name* identifies the cursor. The name must be unique and have a maximum of 255 characters. The name must begin with a letter of the alphabet or with the symbols "#" or "_".
- *cursor sensitivity* specifies the sensitivity of the cursor. The options are:
  - semi_sensitive. If semi_sensitive is specified in the declare statement, scrollability is implied. The cursor is semi_sensitive, scrollable, and read-only.
  - insensitive. If insensitive is specified in the declare statement, the cursor is insensitive. Scrollability is determined by specifying SCROLL in the declare part. If SCROLL is omitted or NOSCROLL is specified, the cursor is insensitive only and non-scrollable. It is also read-only.

  If cursor sensitivity is not specified, the cursor is non-scrollable and read-only.
- *cursor scrollability* specifies the scrollability of the cursor. The options are:

- scroll. If scroll is specified in the declare statement and sensitivity is not specified, the cursor is insensitive and scrollable. It is also read-only.
- no scroll. If the SCROLL option is omitted or NOSCROLL is specified, the cursor is non-scrollable and read-only. See the previous *cursor sensitivity* description for cursor behavior.

If cursor scrollability is not specified, the cursor is non-scrollable and read-only.

- *select_statement* is a select statement that can return multiple rows of data. The syntax for select is the same as described in the *Adaptive Server Enterprise Reference Manual*, except that you cannot use into or compute clauses.

Declaring cursors that release locks at cursor close

The syntax for declaring cursors that release locks when the cursor closes is:

```
exec sql declare  cursor_name  [cursor sensitivity]
[cursor scrollability] [release_locks_on_close]
cursor for  select_statement
[for {read only | update [ of column_name_list]}] ;
```

where:

- *cursor_name* identifies the cursor. The name must be unique and have a maximum of 255 characters. The name must begin with a letter of the alphabet or with the symbols "#" or "_".
- *cursor sensitivity* – See "Declaring scrollable cursors" on page 53.
- *cursor scrollability* – See "Declaring scrollable cursors" on page 53.
- *select_statement* is a select statement that can return multiple rows of data. The syntax for select is the same as described in the *Adaptive Server Enterprise Reference Manual*, except that you cannot use into or compute clauses.
- *column_name_list* identifies the list of columns to be affected.

You cannot use release_locks_on_close with an update clause except in this form:

```
exec sql declare cursor c1 release_locks_on_close
   cursor for select * from T for update of col_a
```

In this case, release_locks_on_close is ignored.

Note cobpre cannot generate these ct_cursor() options:

- CS_CUR_RELLOCKS_ONCLOSE | CS_READ_ONLY
- CS_CUR_RELLOCKS_ONCLOSE | CS_FOR_UPDATE

ESQL/COBOL sample code is available in *example7.pco*.

Opening cursors

To retrieve the contents of selected rows, you must first open the cursor. The open statement executes the select statement associated with the cursor in the declare statement.

The open statement's syntax for opening a cursor is:

```
exec sql open cursor_name [ROW_COUNT = size] end-exec.
```

Note ROW_COUNT should be specified with cursors when arrays are used as host variables and multi-row retrieval is required.

After you declare a cursor, you can open it wherever you can issue a select statement. When the open statement executes, Embedded SQL substitutes the values of any host variables referenced in the declare cursor statement's where clause.

The number of cursors you may have open depends on the resource demands of the current session. Adaptive Server Enterprise does not limit the number of open cursors. However, you cannot open a currently open cursor. Doing so results in an error message.

While an application executes, you can open a cursor as many times as necessary, but you must close it before reopening it. You need not retrieve all the rows from a cursor result set before retrieving rows from another cursor result set.

Fetching data using cursors

Use a fetch statement to retrieve data through a cursor and assign it to host variables. The syntax for the fetch statement is:

```
exec sql [at connect_name] fetch cursor_name
```

```
into : host_variable
[[ indicator]: indicator_variable ]
[,: host_variable
[[ indicator]: indicator_variable ]...];
```

where there is one *host_variable* for each column in the result rows.

Prefix each host variable with a colon and separate it from the next host variable with a comma. The host variables listed in the fetch statement must correspond to Adaptive Server Enterprise values that the select statement retrieves. Thus, the number of variables must match the number of returned values, they must be in the same order, and they must have compatible datatypes.

An *indicator_variable* is a 2-byte signed integer declared in a previous declare section. If a value retrieved from Adaptive Server Enterprise is null, the runtime system sets the corresponding indicator variable to -1. Otherwise, the indicator is set to 0.

The data that the fetch statement retrieves depends on the cursor position. The cursor points to the *current row*. The fetch statement always returns the current row. The first fetch retrieves the first row and copies the values into the host variables indicated. Each fetch advances the cursor to the next result row.

Normally, you should place the fetch statement within a loop so all values returned by the select statement can be assigned to host variables. Following is a loop that is commonly used:

```
   exec sql
        whenever sqlerror perform err-para thru err-para-end
    end-exec.
        exec sql
        whenever not found go to read-end
        end-exec.

* 0 is never equal to 1, so the perform will run
* until the whenever NOT FOUND clause causes
* a jump to READ-END

     PERFORM READ-PARA UNTIL 0 = 1.

 READ-END.
       . . .

 READ-PARA.
     exec sql fetch cursor_name into host-variable-list
     end-exec.
```

```
        . . .
OTHER-PARA.
    . . .
```

This loop continues until all rows are returned or an error occurs. In either case, SQLCODE or SQLSTATE, which the whenever statement checks after each fetch, indicates the reason for exiting the loop. The error-handling routines ensure that an action is performed when either condition arises, as described in Chapter 8, "Handling Errors"

Fetching data using scrollable cursors

Use a fetch statement to retrieve data through a cursor and assign it to host variables. The syntax for the fetch statement is:

```
exec sql [at connect_name] fetch [fetch
orientation] cursor_name
 into : host_variable
 [[ indicator]: indicator_variable ]
 [,: host_variable
 [[ indicator]: indicator_variable ]...];
```

where one *host_variable* exists for each column in the result rows.

Prefix each host variable with a colon, and separate it from the next host variable with a comma. The host variables listed in the fetch statement must correspond to Adaptive Server Enterprise values that the select statement retrieves. Thus, the number of variables must match the number of returned values, they must be in the same order, and they must have compatible datatypes.

The *fetch orientation* specifies the fetch direction of the row to be fetched, if a cursor is scrollable. The options are: NEXT, PRIOR, FIRST, LAST, ABSOLUTE *fetch_offset* and RELATIVE *fetch_offset*. If fetch orientation is not specified, next is default. If fetch orientation is specified, the cursor must be scrollable.

The data that the fetch statement retrieves depends on the cursor position. The fetch statement typically retrieves single or multiple rows from the cursor result set, depending on the ROW_COUNT specification at cursor open time. If a cursor is not scrollable, fetch retrieves the next row in the result set. If a cursor is scrollable, commands in the fetch statement specify the row position to be fetched.

Example for declaring a scrollable cursor and fetching rows

To declare a scrollable cursor and fetch rows at random, specify the scroll sensitivity and scrollability in the declare cursor, then specify the fetch orientation at fetch time. The following example demonstrates declaring an insensitive scrollable cursor and fetching rows at random:

```
exec sql declare c1 insensitive scroll cursor for
 select title_id, royalty, ytd_sales from authors
 where royalty < 25;
exec sql open c1;
```

In this example, scroll and insensitive are specified in the declare cursor. A fetch orientation can be specified at fetch time to indicate which row is required from the result set.

Once a cursor has been declared as scrollable and opened, a FETCH orientation can be specified at fetch time to indicate which row is wanted from the result set.

The following fetch example fetches the specified columns of the first row from the result set:

```
exec sql fetch first from c1 into :title,:roy,:sale;
```

The following fetch example fetches the specified columns of the previous row from the result set:

```
exec sql fetch prior from c1 into :title,:roy,:sale;
```

The following fetch example fetches the specified columns of row twenty from the result set:

```
exec sql fetch absolute 20 from c1 into :title,:roy,:sale;
```

Use *sqlcode* or *sqlstate* to determine if fetch statements return valid rows. For scrollable cursors, it is possible to fetch 0 rows if the cursor is positioned outside of result set boundaries, for example, before the first row or after the last row. In these circumstances, fetching 0 rows is not an error.

Using cursors to update and delete rows

To update or delete the current row of a cursor, specify where current of *cursor_name* as the search condition in an update or delete statement.

To update rows through a cursor, the result columns to be used in the updates must be updatable. They cannot be the result of SQL expressions such as max(colname). In other words, there must be a valid correspondence between the result column and the database column to be updated.

The following example demonstrates how to use a cursor to update rows:

```
    exec sql declare c1 cursor for
          select title_id, royalty, ytd_sales
          from titles
          where royalty < 12
          end-exec

     exec sql open C1 end-exec

     PERFORM READ-PARA UNTIL SQLCODE = 100.
     exec sql close C1 end-exec.
     STOP RUN.
READ-PARA.
     exec sql fetch C1 into :TITLE-ID, :ROYALTY,
          :SALES end-exec.
     IF SALES > 10000
       exec sql update titles
             set royalty = :roy + 2
         where current of C1 end-exec.
```

The Embedded SQL syntax of the update and delete statements is the same as in Transact-SQL, with the addition of the where current of *cursor_name* search condition.

For details on determining table update protocol and locking, see the *Adaptive Server Enterprise Transact-SQL Users Guide.*

Closing cursors

Use the close statement to close an open cursor. The syntax for the close statement is:

```
exec sql [at connection] close cursor_name end-exec
```

To reuse a closed cursor, issue another open statement. When you reopen a cursor, it points to the first row. Do not issue a close statement for a cursor that is not open or an error will result.

Cursor example

The following example shows how to nest two cursors. Cursor C2 depends upon the value fetched into *TITLE-ID* from cursor C1.

The program gets the value of *TITLE-ID* at open time, not at declare time.

```
    ...
 exec sql declare C1 cursor for
     select title_id, title, royalty from titles
```

```
        end-exec

        exec sql declare C2 cursor for
            select au_lname, au_fname, from authors
            where au_id in
                (select au_id from titleauthor
                 where title_id = :TITLE-ID)
        end-exec

        exec sql open C1 end-exec.

        PERFORM READ-TITLE UNTIL SQLCODE = 100.

    READ-END.
     . . .

    READ-TITLE.
        exec sql fetch C1 into
            :TITLE-ID, :TITLE, :ROYALTY end-exec.
        IF SQLCODE NOT = 100
             MOVE ROYALTY TO DISP-ROY
             DISPLAY "Title ID: " TITLE-ID
            ", Royalty: " DISP-ROY
             IF ROYALTY > 10
                exec sql open C2 end-exec
                PERFORM READ-AUTH UNTIL SQLCODE = 100
                exec sql close C2 end-exec.

    READ-AUTH.
        exec sql fetch C2 into :AU-LNAME, :AU-FNAME
        end-exec
        IF SQLCODE NOT = 100
             DISPLAY "  AUTHOR: " AU-LNAME " "
                AU-FNAME.
```

See the online sample programs for more examples using cursors. For details on accessing the online examples, see the *Open Client and Open Server Programmers Supplement*.

Using stored procedures

There are two types of *stored procedures*: user-defined and precompiler-generated. Both types run faster than standalone statements because Adaptive Server Enterprise preoptimizes the queries. You create user-defined stored procedures, and the precompiler generates stored procedures.

User-defined stored procedures

With Embedded SQL, you can execute stored procedures with select statements that return data rows. Stored procedures can return results to your program through output parameters and through a return status variable.

Stored procedure parameters can be either input or both input and output. For details on stored procedures, see the *Adaptive Server Enterprise Transact-SQL Users Guide.*

Syntax

Valid stored procedure names consist of uppercase and lowercase letters and the characters $, _, and #.

Do not include the use statement in a stored procedure.

To execute a stored procedure, use the following syntax:

```
exec sql [at connection_name]
  exec [:status_variable = status_value] procedure_name
 [([[@parameter_name =]parameter_value [out[put]]],...)]
  [into :hostvar_1 [:indicator_1]
  [, hostvar_n [indicator_n, ...]]]
  [with recompile]
 end-exec
```

where:

- *status_variable* can return either an Adaptive Server Enterprise return status value or a return code, which either indicates that the stored procedure completed successfully or gives the reasons for the failure. Negative status values are reserved for Adaptive Server Enterprise use. See the *Adaptive Server Enterprise Transact-SQL Users Guide* for a list of return status values for stored procedures.
- *status_value* is the value of the stored procedure return status variable *status_variable*.
- *procedure_name* is the name of the stored procedure to execute.

- *parameter_name* is the name of a variable in the stored procedure. You can pass parameters either by position or by name, using the *@parameter_name* format. If one parameter is named, all of them must be named. See the *Transact SQL Users Guide*.
- *parameter_value* is a literal constant or host variable whose value is passed to the stored procedure. If it is a host variable, you can associate an indicator with it. Note that this variable has no keyword associated with it.
- output indicates that the stored procedure returns a parameter value. The matching parameter in the stored procedure must also have been created using the output keyword.
- into*:hostvar_1* causes row data returned from the stored procedure to be stored in the specified host variables (*hostvar_1* through *hostvar_n*). Each host variable can have an indicator variable.
- *indicator_n* is a two-byte host variable declared in a previous declare section. If the value for the associated *hostvar_n* is null, the indicator variable is set to -1 when the row data is retrieved. If truncation occurs, the indicator variable is set to the actual length of the result column. Otherwise, the indicator variable is 0.
- with recompile causes Adaptive Server Enterprise to create a new query plan for this stored procedure each time the procedure executes.

Note In Embedded SQL, the exec keyword is required to execute a stored procedure. You cannot substitute execute for exec.

Stored procedure example

The following example shows a call to a stored procedure where *RET-CODE* is a status variable, a_proc is the stored procedure, *PAR–1* is an input parameter, and *PAR–2* is an output parameter:

```
exec sql begin declare section end-exec
  01  PAR-1              PIC S9(9) COMP.
  01  PAR-2              PIC S9(9) COMP.
  01  RET-CODE           PIC S9(4) COMP.
 exec sql end declare section end-exec
     . . .
     exec sql exec :RET-CODE=a_proc :PAR-1,
                   :PAR-2 out end-exec.
```

The next example demonstrates the use of a stored procedure that retrieves data rows. The name of the stored procedure is "*get_publishers*":

```
exec sql begin declare section end-exec.
  01  PUB-ID            PIC X(4).
  01  NAME              PIC X(45).
  01  CITY              PIC X(25).
  01  STATE             PIC X(2).
  01  RET-CODE          PIC S9(9).
 exec sql end declare section end-exec.
    . . .
 exec sql exec :RET-CODE = get_publishers :PUB-ID
                    into :NAME :CITY :STATE END-EXEC.
```

See Chapter 10, “Open Client/Server Configuration File” for a more detailed example of the exec statement.

Conventions

The datatypes of the stored procedure parameters must be compatible with the COBOL host variables. Client-Library only converts certain combinations. See Chapter 4, “Using Variables” for a table of compatible datatypes.

Precompiler-generated stored procedures

You can set an optional command line switch so that the precompiler automatically generates stored procedures that can optimize the execution of Transact-SQL statements in your program.

For the list of precompiler command line option switches, see the *Open Client and Open Server Programmers Supplement*.

Follow these steps to activate precompiler-generated stored procedures:

1 Set the appropriate command line switch so that the precompiler automatically generates stored procedures for the Transact-SQL statements to be optimized.

   The precompiler generates an isql file containing statements that generate the stored procedures.

2 Use interactive SQL (the isql program) to execute the file.

   This loads the stored procedures on Adaptive Server Enterprise. The precompiler also creates the stored procedure calls in its output file.

By default, precompiler-generated stored procedures have the same name as the source program, minus any file extensions. The stored procedures are numbered sequentially and the file name and number are separated by a semicolon (;).

For example, the stored procedures for a source program named *test1.pco*, would be named *test1;1* through *test1;n*, where *n* is the number of the source program's last stored procedure.

Optionally, you can set a command line flag that lets you alter the stored procedures' names. By using this flag, you can test a modified application without deleting a stored procedure already in production. After successfully testing the application, you can precompile it without the flag to install the stored procedure.

Note When you issue the declare cursor statement, only the select clause is saved as a stored procedure. If an application has syntax errors, the precompiler generates neither the target file nor stored procedures.

Grouping statements

Statements can be grouped for execution by batch or by transactions.

Grouping statements by batches

A batch is a group of statements you submit as one unit for execution. The precompiler executes all Transact-SQL statements within the exec sql and end-exec keywords in batch mode.

Although the precompiler saves stored procedures, it does not save batches for re-execution. The batch is effective only for the current execution.

The precompiler supports only batch mode statements that return no result sets.

```
exec sql insert into TABLE1 values (:val1)
     insert into TABLE2 values (:val2)
     insert into TABLE3 values (:val3)
 end-exec.
```

The three insert statements are processed as a group, which is more efficient than being processed individually. Use the get diagnostics method of error handling with batches. For details, see "Using get diagnostics" on page 100.

These statements are legal within a batch because none of them returns results. See the *Adaptive Server Enterprise Transact-SQL Users Guide*.

Grouping statements by transactions

A *transaction* is a single unit of work, whether the unit consists of one or 100 statements. The statements in the transaction execute as a group, so either all or none of them execute.

The precompiler supports two transaction modes: default ANSI/ISO and optional Transact-SQL. In the Transact-SQL transaction mode, each statement is implicitly committed unless it is preceded by a begin transaction statement.

The Transact-SQL mode uses relatively few system resources, while the default ANSI/ISO transaction mode can dramatically affect system response time. For details on choosing the appropriate mode for your application, see the *Adaptive Server Enterprise Transact-SQL Users Guide*.

You can use a precompiler option to determine the **transaction mode** of the connections your application opens. See the *Open Client and Open Server Programmers Supplement* for details.

Transact-SQL transaction mode

In this optional Transaction mode, the Embedded SQL syntax is the same as that used in Transact-SQL. The begin transaction statement explicitly initiates transactions.

The syntax of the Embedded SQL transaction statements is:

```
exec sql [at connect_name]
     begin transaction [transaction_name] end-exec

exec sql [at connect_name]
     save transaction [savepoint_name] end-exec
exec sql [at connect_name] commit transaction
     [transaction_name] end-exec
exec sql [at connect_name] rollback transaction
     [savepoint_name | transaction_name] end-exec
```

Note disconnect rolls back all open transactions. For details on this statement, see Chapter 5, “Connecting to Adaptive Server Enterprise.”

When you issue a begin transaction on a connection, you must also issue a save, commit, or roll back transaction on the same connection. Otherwise, an error is generated.

Default ANSI/ISO transaction mode

ANSI/ISO SQL does not provide a save transaction or begin transaction statement. Instead, transactions begin implicitly when the application program executes one of the following statements:

- delete
- insert
- select
- update
- open
- exec

The transaction ends explicitly when you issue either a commit work or rollback work statement. You must use the ANSI/ISO forms of the commit and rollback statements.

The syntax is:

```
exec sql commit [work] end-exec
exec sql rollback [work] end-exec
```

Extended transactions

An **extended transaction** is a unit of work that has multiple Embedded SQL statements. In the Transact-SQL transaction mode, you surround an extended transaction statement with the begin transaction and commit transaction statements.

In the default ANSI mode, you are constantly within an extended transaction. When you issue a commit work statement, the current extended transaction ends and another begins. For details, see the *Adaptive Server Enterprise Transact-SQL Users Guide*.

Note Unless the database option allow ddl in tran is set, do not use the following Transact-SQL statements in an extended, ANSI-mode transaction: alter database, create database, create index, create table, create view, disk init, grant, load database, load transaction, revoke, truncate table, and update statistics.

Including files and directories

The include statement is essentially the same as the COBOL COPY command, except that file search and copy occur at precompile time. At precompile time, include searches for the file in the directory or directories specified in the precompile statement. See the *Open Client and Open Server Programmers Supplement* for details about using the precompile statement and the COBOL compiler in your environment.

You can use the Embedded SQL include statement to add any source code file to your application, such as common data definitions, just as you use the COBOL COPY command. Hence, the following example is valid:

```
exec sql include "myfile" end-exec.
```

The precompiler changes include statements into COBOL COPY commands, surrounding the file name with quotation marks.

You can also set a precompiler command option to specify an include file directory. At precompile time, the precompiler searches the path specified in the COBOL compile command. When you specify a directory using this option, the precompiler adds the directory to the file name and encloses the entire path name in quotation marks. The file's path is then hard-coded into the target program. See the *Open Client and Open Server Programmers Supplement* for details.

CHAPTER 7

Using Dynamic SQL

This chapter explains dynamic SQL, an advanced methodology that lets your Embedded SQL application users enter SQL statements while the application is running. While static SQL will suffice for most of your needs, dynamic SQL provides the flexibility to build diverse SQL statements at runtime.

Dynamic SQL is a set of Embedded SQL statements that permit users of online applications to access the database interactively at runtime.

Use dynamic SQL when one or more of the following conditions is not known until runtime:

- SQL statement the user will execute
- Column, index, and table references
- Number of host variables or their datatypes

Dynamic SQL is part of ANSI and the ISO SQL2 standard. It is useful for running interactive applications.

When to use dynamic SQL

If the application accepts only a small set of SQL statements, you can embed them within the program. However, if the application accepts many types of SQL statements, you can benefit from constructing SQL statements, and then binding and executing them dynamically.

The following type of situation would benefit from using dynamic SQL: The application program searches a bookseller's database of books for sale. A potential buyer can apply many criteria, including price, subject matter, type of binding, number of pages, publication date, language, and so on.

A customer might say, "I want a nonfiction book about business that costs between $10 and $20." This request is readily expressed as a Transact-SQL statement:

```
select * from titles where
 type = "business"
 and price between $10 and $20
```

It is not possible to anticipate the combinations of criteria that all buyers will apply to their book searches. Therefore, without using dynamic SQL, an Embedded SQL program can not easily generate a list of prospective books with a single **query**.

With dynamic SQL, the bookseller can enter a query with a different where clause search condition for each buyer. The seller can vary requests based on the publication date, book category, and other data, and can vary the columns to be displayed. For example:

```
select * from titles
     where type = ?
     and price between ? and ?
```

The question marks ("?") are dynamic parameter markers that represent places where the user can enter search values.

Dynamic SQL protocol

Note The precompiler does not generate stored procedures for dynamic SQL statements because the statements are not complete until runtime. At runtime, Adaptive Server Enterprise stores them as temporary stored procedures in the tempdb database. The tempdb database must contain the user name "guest", which in turn must have create procedure permission. Otherwise, attempting to execute one of these temporary stored procedures generates the error message "Server user id *user_id* is not a valid user in database *database_name*", where *user_id* is the user's user ID, and *database_name* is the name of the user's database.

The dynamic SQL prepare statement sends the actual SQL statement, which can be any Data Definition Language (DDL) or Data Manipulation Language (DML) statements or any Transact-SQL statement, except create procedure, to the server.

The dynamic SQL facility performs these actions:

1 Translates the input data into a SQL statement.

2 Verifies that the SQL statement can execute dynamically.

3 Prepares the SQL statement for execution, sending it to Adaptive Server Enterprise, which compiles and saves it as a temporary stored procedure (for methods 2, 3, and 4).

4 Binds all input parameters or descriptor (for methods 2, 3, and 4).

5 Executes the statement.

   For a varying-list select, it uses a descriptor to reference the data items and rows returned (for method 2 or 4).

6 Binds the output parameters or descriptor (for method 2, 3, or 4).

7 Obtains results (for method 2, 3, or 4).

8 Drops the statement (for methods 2, 3, and 4) by reactivating the stored procedure in Adaptive Server Enterprise.

9 Handles all error and warning conditions from Adaptive Server Enterprise and Client-Library.

Method 1: Using execute immediate

Use execute immediate to send a complete Transact-SQL statement, stored in a host variable or literal string, to Adaptive Server Enterprise. The statement cannot return any results—you cannot use this method to execute a select statement.

The dynamically entered statement executes as many times as the user invokes it during a session. With this method:

1 The Embedded SQL program passes the text to Adaptive Server Enterprise.

2 Adaptive Server Enterprise verifies that the statement can execute dynamically and does not return rows.

3 Adaptive Server Enterprise compiles and executes the statement.

With execute immediate, you can let the user enter all or part of a Transact-SQL statement.

The syntax for execute immediate is:

```
exec sql [at connection_name] execute immediate
     {:host_variable | "string"} end-exec
```

where:

- *host_variable* is a character-string variable defined in a declare section. Before calling execute immediate, the host variable should contain a complete and syntactically correct Transact-SQL statement.
- *string* is a literal Transact-SQL statement string that can be used in place of *host_variable*.

Embedded SQL sends the statement in *host_variable* or string to Adaptive Server Enterprise without any processing or checking. If the statement attempts to return results or fails, an error occurs. You can test the value of SQLCODE after executing the statement or use the whenever statement to set up an error handler. See Chapter 8, “Handling Errors” for information about handling errors in Embedded SQL programs.

Method 1 examples

The following two examples demonstrate using method 1, execute immediate. The first example prompts the user to enter a statement and then executes it:

```
exec sql begin declare section end-exec
01  CMD-1              PIC X(50).
01  SRC-COND           PIC X(50).
01  SQLSTR1            PIC X(200).
exec sql end declare section end-exec

DISPLAY "ENTER statement".
ACCEPT SQLSTR1.
exec sql execute immediate :SQLSTR1 end-exec.
```

The next example prompts the user to enter a search condition to specify rows in the titles table to update. Then, it concatenates the search condition to an update statement and sends the complete statement to Adaptive Server Enterprise.

```
MOVE "UPDATE titles SET price = price*1.10 WHERE "
```

```
     TO CMD-1.
DISPLAY "ENTER SEARCH CONDITION:".
ACCEPT SRC-COND.
STRING CMD-1 delimited by size SRC-COND DELIMITED BY
SIZE INTO SQLSTR1.
exec sql execute immediate :SQLSTR1 end-exec.
```

Method 2: Using prepare and execute

Use method 2, prepare and execute, when one of the following cases is true:

- You are certain that no data will be retrieved and you want the statement to execute more than once.
- A select statement is to return a single row. With this method, you cannot associate a cursor with the select statement.

This process is also called a single-row select. If a user needs to retrieve multiple rows, use method 3 or 4.

This method uses prepare and execute to substitute data from COBOL variables into a Transact-SQL statement before sending the statement to Adaptive Server Enterprise. The Transact-SQL statement is stored in a character buffer with dynamic parameter markers to show where to substitute values from COBOL variables.

Because this statement is prepared, Adaptive Server Enterprise compiles and saves it as a temporary stored procedure. Then, the statement executes repeatedly, as needed, during the session.

The prepare statement associates the buffer with a statement name and prepares the statement for execution. The execute statement substitutes values from a list of COBOL variables into the buffer and sends the completed statement to Adaptive Server Enterprise. You can execute any Transact-SQL statement this way.

prepare

The syntax for the prepare statement is:

```
exec sql [at connection_name] prepare
     statement_name from {:host_variable | "string"}
```

```
    end-exec
```

where:

- *statement_name* is a name up to 255 characters long that identifies the statement. It is not a COBOL variable or a literal string. It is a symbolic name that the precompiler uses to associate an execute statement with a prepare statement.
- *host_variable* is a dynamic parameter marker.

  Precede the dynamic parameter marker with a colon in standard Embedded SQL statements.
- *string* is a literal string that can be used in place of *host_variable*.

execute

The syntax for the execute statement is:

```
exec sql [at connection_name] execute statement_name
     [into {host_var_list | sql descriptor
         descriptor_name | descriptor sqlda_name }]
     [using {host_var_list | sql descriptor
         descriptor_name | descriptor sqlda_name}]
 end-exec
```

where:

- *statement_name* is the name assigned in the prepare statement. into is used for a single-row select.
- into is used for a single-row select.
- using specifies the COBOL variables or descriptors that are substituted for dynamic parameter markers in variables in the *host_var_list*. The variables, which you must define in a declare section, are substituted in the order listed. You need only this clause when the statement contains variables using dynamic parameter markers.
- *descriptor_name* represents the area of memory that holds a description of the dynamic SQL statement's dynamic parameter markers.
- *host_var_list* is a list of host variables to substitute into the parameter markers ("?") in the query.
- *sqlda_name* is the name of the SQLDA.

Method 2 example

The following example demonstrates using prepare and execute in method 2. In this example, the user is prompted to enter a where clause that determines which rows in the titles table to update. For example, entering "1.1" increases the price by 10 percent.

```
01  CUST-TYPE   PIC X.
     88  BIG-CUSTOMER   VALUE "B".
     88  OTHER-CUSTOMER VALUE "O".
 . . .
 exec sql begin declare section end-exec
 01  MULTIPLIER         PIC S9(2) COMP.
 01  CMD-1              PIC X(50).
 01  SRC-COND           PIC X(50).
 01  SQLSTR1            PIC X(200).
 exec sql end declare section end-exec

     MOVE "UPDATE titles SET
         " price = price + (price * ? / 100)
         WHERE "
         TO CMD-1.
     DISPLAY "ENTER SEARCH CONDITION:".
     ACCEPT SRC-COND.
     STRING CMD-1 SRC-COND DELIMITED BY SIZE
         INTO SQLSTR1.

     exec sql prepare statement1 from :SQLSTR1
     end-exec.

     IF BIG-CUSTOMER
         MOVE 10 TO MULTIPLIER
     ELSE
         MOVE 25 TO MULTIPLIER.

 exec sql execute statement1 using :MULTIPLIER
 end-exec.
```

Method 3: Using prepare and fetch with a cursor

Method 3 uses the prepare statement with cursor statements to return results from a select statement. Use this method for fixed-list select statements that may return multiple rows. That is, use it when the application has determined in advance the number and type of select column list attributes to be returned. You must anticipate and define host variables to accommodate the results.

When you use method 3, include the declare, open, fetch, and close cursor statements to execute the statement. This method is required because the statement returns more than one row. There is an association between the prepared statement identifier and the specified cursor name. You can also include update and delete where current of cursor statements.

As with method 2, a Transact-SQL select statement is first stored in a character host variable or string. It can contain dynamic parameter markers to show where to substitute values from input variables. The statement is given a name to identify it in the prepare, declare, and open statements.

Method 3 requires five steps:

1 prepare

2 declare

3 open

4 fetch (and, optionally, update and delete)

5 close

These steps are described below.

prepare

The prepare statement is the same as that used with method 2. For details, see “prepare” on page 73.

declare

The declare statement is similar to the standard declare statement for cursors. In dynamic SQL, however, you declare the cursor for a prepared *statement_name* instead of for a select statement, and any input host variables are referenced in the open statement instead of in the declare statement.

A dynamic declare statement is an executable statement rather than a declaration. As such, it must be positioned in the code where executable statements are legal, and the application should check status codes (SQLCODE, SQLCA, or SQLSTATE) after executing the declaration.

The dynamic SQL syntax for the declare statement is:

```
exec sql [at connection_name] declare cursor_name
     cursor for statement_name end-exec
```

where:

- at *connection_name* specifies the Adaptive Server Enterprise connection the cursor will use.
- *cursor_name* identifies the cursor, used with the open, fetch, and close statements.
- *statement_name* is the name specified in the prepare statement, and represents the select statement to be executed.

open

The open statement substitutes any input variables in the statement buffer, and sends the result to Adaptive Server Enterprise for execution. The syntax for the open statement is:

```
exec sql [at connection_name] open cursor_name
    [using {host_variable_list |
     sql descriptor descriptor_name | descriptor sqlda_name}]
 end-exec
```

where:

- *cursor_name* is the name given to the cursor in the declare statement.
- *host_variable_list* consists of the names of the host variables that contain the value for a dynamic parameter marker.
- *descriptor_name* is the name of the descriptor that contains the value for the dynamic parameter markers.
- *sqlda_name* is the name of the SQLDA.

fetch and *close*

After a cursor opens, the result sets are returned to the application. Then, the data is fetched and loaded into the application program host variables. Optionally, you can update or delete the data. The fetch and close statements are the same as in static Embedded SQL.

The syntax for the fetch statement is:

```
exec sql [at connection_name] fetch cursor_name
    into :host_variable
         [[indicator]:indicator_variable]
     [,:host_variable
     [[indicator]:indicator_variable]...]
 end-exec
```

where:

- *cursor_name* is the name given to the cursor in the declare statement.
- There is one COBOL *host_variable* for each column in the result rows. The variables must have been defined in a declare section, and their datatypes must be compatible with the results returned by the cursor.

The syntax for the close statement is:

```
exec sql [at connection_name] close cursor_name
end-exec
```

where *cursor_name* is the name assigned to the cursor in the declare statement.

Method 3 example

The following example uses prepare and fetch, and prompts the user for an order by clause in a select statement:

```
exec sql begin declare section end-exec
 01  AGE                PIC S9(2) COMP.
 01  R-AGE              PIC S9(2).
 01  ROYALTY            PIC S9(9) COMP.
 01  TITLE              PIC X(25).
 01  MANAGER            PIC X(25).
 01  SQLSTR2            PIC X(100).
 01  I-TITLE            PIC S9(4) COMP.
 01  I-AGE              PIC S9(4) COMP.
 exec sql end declare section end-exec

 01  DSP-AGE            PIC  9(2).
```

```
 01  DSP-ROYALTY        PIC -ZZZ,ZZZ,ZZZ.

 PROCEDURE DIVISION.

     MOVE 60 TO R-AGE.

MOVE "select age, royalty, title, manager from
 -          " inprogr where age !=?" TO SQLSTR2
 MOVE 0 TO I-AGE.
     exec sql prepare statement2 from :SQLSTR2
         end-exec.
     exec sql declare C1 cursor for statement2
         end-exec
     exec sql whenever not found goto NOT-FOUND
         end-exec
     exec sql open C1 using :R-AGE indicator :I-AGE
         end-exec.

 RET-LOOP.
     MOVE 0 TO I-TITLE.

     exec sql fetch C1 into
         :AGE, :ROYALTY,
         :TITLE indicator :I-TITLE,
         :MANAGER end-exec.

     MOVE AGE TO DSP-AGE.
     MOVE ROYALTY TO DSP-ROYALTY.
     IF I-TITLE = -1
         MOVE "Null" TO TITLE.

     DISPLAY "Age = " DSP-AGE
             " Royalty = " DSP-ROYALTY
             " Title = " TITLE
             " Manager = " MANAGER.
     DISPLAY " ".
     GO TO RET-LOOP.

 NOT-FOUND.
     exec sql close C1 end-exec.
```

Method 4: Using prepare and fetch with system descriptors

This method permits varying-list select statements. That is, when you write the application, you need not know the formats and number of items the select statement will return.

Use this method when you cannot define the host variables in advance because you do not know how many variables are needed or of what type they should be.

Method 4 dynamic descriptors

A **dynamic descriptor** is a data structure that holds a description of the variables used in a dynamic SQL statement. There are two kinds of dynamic descriptors—SQL descriptors and SQLDA structures. Both are described later in this chapter.

When a cursor opens, it can have an input descriptor associated with it. The input descriptor contains the values to be substituted for the dynamic SQL statement's parameter markers.

Before the cursor is opened, the user fills in the input descriptor with the appropriate information, including the number of parameters, and, for each parameter, its type, length, precision, scale, indicator, and data.

Associated with the fetch statement is an output descriptor, which holds the resultant data. Adaptive Server Enterprise fills in the data item's attributes, including its type and the actual data being returned. If you are using an SQL descriptor, use the get descriptor statement to copy the data into host variables.

Dynamic SQL method 4 performs the following:

1 Prepares the statement for execution.

2 Associates a cursor with the statement.

3 Defines and binds the input parameters or descriptor and:

- If using an input descriptor, allocates it
- If using an input host variable, associates it with the statement or cursor

4 Opens the cursor with the appropriate input parameter(s) or descriptor.

5 Allocates the output descriptor if different from the input descriptor and binds the output descriptor to the statement.

6 Retrieves the data by using fetch cursor and the output descriptor.

7 Copies data from the **dynamic descriptor** into host program variables. If you are using an SQLDA, this step does not apply; the data is copied in step 6.

8 Closes the cursor.

9 Deallocates the dynamic descriptors.

10 Drops the statement (ultimately, the stored procedure).

Dynamic descriptor statements

There are statements that associate the descriptor with a SQL statement and with a cursor associated with the SQL statement. The following list briefly describes dynamic SQL statements for method 4:

Statement	Description
allocate descriptor	Notifies Client-Library to allocate a SQL descriptor.
describe input	Obtains information about the dynamic parameter marker in the prepare statement.
set descriptor	Inserts or updates data in the system descriptor.
get descriptor	Moves row or parameter information stored in a descriptor into host variables, thereby allowing the application program to use the information.
execute	Executes a prepared statement.
open cursor	Associates a descriptor with a cursor and opens the cursor.
describe output	Obtains information about the select list columns in the prepared dynamic SQL statement.
fetch cursor	Retrieves a row of data for a dynamically declared cursor.
deallocate descriptor	Deallocates a dynamic descriptor.

For complete descriptions of these statements, see Chapter 9, “Embedded SQL Statements: Reference Pages.”

About SQL descriptors

A SQL descriptor is an area of memory that stores a description of the variables used in a prepared dynamic SQL statement. A SQL descriptor can contain the following information about data attributes.

- *precision* – integer.
- *scale* – integer.
- *nullable* – 1 (*cs_true*) if the column can contain nulls; 0 (*cs_false*) if it cannot. Valid only with get descriptor statement.
- *indicator* – value for the indicator parameter associated with the dynamic parameter marker.
- *name* – name of the dynamic parameter marker. Valid only with get descriptor statement.
- *data* – value for the dynamic parameter marker specified by the item number. If the value of *indicator* is -1, the value of *data* is undefined.
- *count* – number of dynamic parameter markers described in the descriptor.
- *type* – datatype of the dynamic parameter marker or host variable.
- *returned_length* – actual length of the data in an output column.

See the descriptions of the set descriptor and get descriptor commands in Chapter 9, “Embedded SQL Statements: Reference Pages.”

Method 4 example

The following example uses prepare and fetch with dynamic parameter markers and SQL descriptors.

```
exec sql begin declare section end-exec.
     01 COLTYPE      IS GLOBAL PIC S9(9) COMP.
      01 INDEX-COLCNT IS GLOBAL PIC S9(9) COMP.
      01 INT-BUFF     IS GLOBAL PIC S9(9) COMP.
      01 CHAR-BUFF    IS GLOBAL PIC X(255).
      01 MISC-BUFF    IS GLOBAL PIC X(255).
      01 TYPE         IS GLOBAL PIC X(255).
      01 TITLE        IS GLOBAL PIC X(255).
      01 COLNAME      IS GLOBAL PIC X(255).
      01 SALES        IS GLOBAL PIC S9(9) COMP.
      01 DESCNT       IS GLOBAL PIC S9(9) COMP.
      01 OCCUR        IS GLOBAL PIC S9(9) COMP.
```

```
      01 CNT          IS GLOBAL PIC S9(9) COMP.
      01 CONDCNT      IS GLOBAL PIC S9(9) COMP.
      01 DIAG-CNT     IS GLOBAL PIC S9(9) COMP.
      01 NUM-MSGS     IS GLOBAL PIC S9(9) COMP.
      01 USER-ID      IS GLOBAL PIC X(30).
      01 PASS         IS GLOBAL PIC X(30).
      01 SERVER-NAME  IS GLOBAL PIC X(30).
      01 STR1         IS GLOBAL PIC X(1024).
      01 STR2         IS GLOBAL PIC X(1024).
      01 STR3         IS GLOBAL PIC X(1024).
      01 STR4         IS GLOBAL PIC X(1024).
 exec sql end declare section end-exec.
...
PROCEDURE DIVISION.
  P0.
DISPLAY "Dynamic sql Method 4".
 DISPLAY "Enter in a Select statement to retrieve
 any kind "
 DISPLAY "of information from the pubs database:".
 accept str4.
 DISPLAY "Enter in the larger of the columns to be "
 DISPLAY "retrieved or the number "
 DISPLAY "of ? in the SQL statement:".
 ACCEPT occur.
exec sql prepare S4 from :str4 end-exec
exec sql declare c2 cursor for s4 end-exec
exec sql describe input s4 using sql descriptor dinout
end-exec
     call "filldesc".
exec sql open c2 using sql descriptor dinout
 end-exec
PERFORM UNTIL SQLCODE = 100 OR SQLCODE < 0
exec sql fetch c2 into sql descriptor dinout end-exec
PERFORM "prtdesc".
 END-PERFORM.
exec sql close c2 end-exec
exec sql deallocate descriptor dinout end-exec
exec sql deallocate prepare s4 end-exec
DISPLAY "Dynamic SQL Method 4 completed".
     goback.
END PROGRAM dyn-m4.
IDENTIFICATION DIVISION.
 PROGRAM-ID. prtdesc is common.
 ENVIRONMENT DIVISION.
 CONFIGURATION SECTION.
 SOURCE-COMPUTER. xyz.
```

```
 OBJECT-COMPUTER. xyz.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
PROCEDURE DIVISION.
P0.
exec sql get descriptor dinout :descnt = count
 end-exec
DISPLAY "Column name Column data".
DISPLAY "----------- --------------------------"
DISPLAY "---------------".
PERFORM VARYING CNT FROM 1 BY 1 UNTIL cnt > descnt
* get each column attribute
 exec sql get descriptor dinout
    VALUE :index-colcnt :coltype = TYPE end-exec
         IF coltype = 1
* character type
exec sql get descriptor dinout VALUE :index-colcnt
    :colname = NAME, :char-buff = data end-exec
DISPLAY colname char-buff.
ELSE IF coltype = 4
 * integer type
exec sql get descriptor dinout
 VALUE :index-colcnt :colname = NAME, :int-buff = DATA
end-exec
DISPLAY colname int-buff.
     else
* other types
 exec sql get descriptor dinout
 VALUE :index-colcnt
 :colname = NAME, :misc-buff = DATA end-exec
DISPLAY colname misc-buff
    end-perform.
     goback.
 END PROGRAM prtdesc.
...
PROCEDURE DIVISION.
 P0.
exec sql get descriptor dinout :descnt = count
 end-exec
     PERFORM varying cnt from 1 by 1 UNTIL cnt >
     descnt
     DISPLAY "Enter in the data type of the " cnt "
     ?".
     accept &coltype.
     IF coltype = 1
 * character type
```

```
            DISPLAY "Enter in the value of the data:".
          ACCEPT char-buff.
           exec sql set descriptor dinout
                  VALUE :cnt TYPE = 1,
                  LENGTH = 255, DATA = :char-buff
end-exec
          ELSE IF coltype = 4
* integer type
           DISPLAY "Enter in the value of the data:".
           ACCEPT int-buff.
           exec sql set descriptor dinout
                  VALUE :cnt TYPE = :coltype,
                  DATA = :int-buff END-EXEC
          ELSE
          DISPLAY "non-supported column type.".
          END-IF.
          END-PERFORM
     GOBACK
    END PROGRAM filldesc.
...
```

About SQLDAs

SQLDA is a host-language structure that, like an SQL descriptor, describes the variables used in a dynamic SQL prepared statement. Unlike SQL descriptors, SQLDAs are public data structures whose fields you can access. Statements using SQLDAs may execute faster than equivalent statements using SQL descriptors.

The SQLDA structure is not part of the SQL standard. Different implementations of Embedded SQL define the SQLDA structure differently. Embedded SQL version 11.1 and later supports the SQLDA defined by Sybase; it does not support SQLDA datatypes defined by other vendors.

Embedded SQL does not limit the number of SQLDA structures that can be created by a program.

Table 7-1 describes the fields of the SQLDA structure.

Table 7-1: Fields of the SQLDA structure

Field	Datatype	Description
SD-SQLN	PIC S9(9) COMP	The size of the sd_column array.
SD-SQLD	PIC S9(9) COMP	The number of columns in the query being described, or 0 if the statement being described is not a query. For fetch, open, and execute statements, this field indicates the number of host variables described by occurrences of sd_column or the number of dynamic parameter markers for the describe input statement.
SD-DATAFMT OF SD-COLUMN	Data format structure	The Client-Library CS_DATAFMT structure associated with this column. Refer to descriptions of ct_bind, ct_param and ct_describe in the *Open Client Client-Library/C Reference Manual*.
SD-SQLDATA OF SD-COLUMN	PIC S9(9) COMP or PIC S9(18) COMP	For fetch, open, and execute statements, stores the address of the statement's host variable. This field is not used for describe or prepare statements.
SD-SQLIND OF SD-COLUMN	PIC S9(4) COMP	For fetch, open, and execute statements, this field acts as an indicator variable for the column being described. If the column's value is null, this field is set to -1. This field is not used for describe or prepare statements. Set this field using SYBSETSQLDA (see "Using SYBSETSQLDA" on page 87).
SD-SQLLEN OF SD-COLUMN	PIC S9(9) COMP	The actual size of the Client Library CS_DATAFMT structure associated with this column.

Field	Datatype	Description
SD-SQLMORE OF SD-COLUMN	PIC S9(9) COMP or PIC S9(18) COMP	Reserved.

Using SYBSETSQLDA

Since definitions of SQLDA fields do not correspond clearly to COBOL declarations, the SYBSETSQLDA function is provided so that you can use familiar COBOL terms. SYBSETSQLDA allows you to set the fields of a Sybase-style SQLDA. It sets the
ITEM-NUMBER SQLDA-SQLDATA field of the given SQLDA to point to a given buffer, and sets datafmt fields appropriately.

Syntax

```
01 SQLDA-NAME.
< rest of sqlda declaration >
01 ITEM-NUMBER PIC S9(9) COMP.
 01 DATA-BUFFER < picture >.
 01 PICTURE-TYPE PIC S9(9) COMP.
 01 M PIC S9(9) COMP.
 01 N PIC S9(9) COMP.
 01 USAGE-TYPE PIC S9(9) COMP.
 01 SIGN-TYPE PIC S9(9) COMP
 CALL "SYBSETSQLDA" USING SQLDA-NAME ITEM-NUMBER
 DATA-BUFFER PICTURE-TYPE M N USAGE-TYPE SIGN-TYPE
```

where:

- SQLDA-NAME is the SQLDA to set the information in.
- ITEM-NUMBER is the item to set the information for.
- DATA-BUFFER is the host variable with data.
- PICTURE-TYPE is the kind of picture clause the data has. See Table 7-2 for possible values.
- M is the value of “m” in the picture clause, as described in the table, or 0 if no picture.

- N is the value of “n” in the picture clause as described above, or 0 if no picture.
- SIGN-TYPE is the sign clause used to define the data.
  SeeTable 7-2 for possible values.
- USAGE-TYPE is the usage clause used to define the data. See Table 7-2 for possible values.

Table 7-2: Values for SYBSETSQLDA

Argument	Value	Meaning
USAGE-TYPE	SYB-BINARY-USAGE	USAGE IS BINARY
USAGE-TYPE	SYB-COMP-USAGE	USAGE IS COMP
USAGE-TYPE	SYB-COMP1-USAGE	USAGE IS COMP-1
USAGE-TYPE	SYB-COMP2-USAGE	USAGE IS COMP-2
USAGE-TYPE	SYB-COMP3-USAGE	USAGE IS COMP-3
USAGE-TYPE	SYB-COMP4-USAGE	USAGE IS COMP-4
USAGE-TYPE	SYB-COMP5-USAGE	USAGE IS COMP-5
USAGE-TYPE	SYB-COMP6-USAGE	USAGE IS COMP-6
USAGE-TYPE	SYB-COMPX-USAGE	USAGE IS COMP-X
USAGE-TYPE	SYB-DISPLAY-USAGE	USAGE IS DISPLAY
USAGE-TYPE	SYB-POINTER-USAGE	USAGE IS POINTER
USAGE-TYPE	SYB-INDEX-USAGE	USAGE IS INDEX
USAGE-TYPE	SYB-MONEY-USAGE	USAGE IS CS-MONEY
USAGE-TYPE	SYB-MONEY4-USAGE	USAGE IS CS-MONEY4
USAGE-TYPE	SYB-DATE-USAGE	USAGE IS CS-DATE
USAGE-TYPE	SYB-TIME-USAGE	USAGE IS CS-TIME
USAGE-TYPE	SYB-DATETIME-USAGE	USAGE IS CS-DATETIME
USAGE-TYPE	SYB-DATETIME4-USAGE	USAGE IS CS-DATETIME4
USAGE-TYPE	SYB-NO-USAGE	No usage clause

Argument	Value	Meaning
PICTURE-TYPE	SYB-NO-PIC	No picture clause
PICTURE-TYPE	SYB-SNINES-PIC	PIC S9(m)
PICTURE-TYPE	SYB-NINES-PIC	PIC 9(m)
PICTURE-TYPE	SYB-SVNINES-PIC	PIC S9(m)V9(n) or SV9(n)
PICTURE-TYPE	SYB-VNINES-PIC	PIC 9(m)V9(n) or V9(n)
PICTURE-TYPE	SYB-X-PIC	PIC X(m)
SIGN-TYPE	SYB-NO-SIGN	No sign clause (not an unsigned PIC clause)
SIGN-TYPE	SYB-LEADING-SEPARATE-SIGN	SIGN LEADING SEPARATE
SIGN-TYPE	SYB-TRAILING-SEPARATE-SIGN	SIGN TRAILING SEPARATE
SIGN-TYPE	SYB-LEADING-SIGN	SIGN LEADING
SIGN-TYPE	SYB-TRAILING-SIGN	SIGN TRAILING

Returns

No return value.

Method 4 example using SQLDAs

Following is an example that uses prepare and fetch with dynamic parameter markers and SQL descriptors.

```
IDENTIFICATION DIVISION.
PROGRAM-ID.  unittest.
ENVIRONMENT DIVISION.
CONFIGURATION SECTION.
SOURCE-COMPUTER.  xyz.
OBJECT-COMPUTER.  xyz.
DATA DIVISION.
WORKING-STORAGE SECTION.
exec sql begin declare section end-exec
 01 uid pic x(10).
 01 pass pic x(10).
```

```
    exec sql end declare section end-exec
     01 input-descriptor.
             09 SD-SQLN PIC S9(4) COMP.
             09 SD-SQLD PIC S9(4) COMP.
             09 SD-COLUMN OCCURS 3 TIMES.
              19 SD-DATAFMT.
                    29 SQL--NM PIC X(132).
                    29 SQL--NMLEN PIC S9(9) COMP.
                 29 SQL--DATATYPE PIC S9(9) COMP.
                 29 SQL--FORMAT PIC S9(9) COMP.
                     29 SQL--MAXLENGTH PIC S9(9) COMP.
                     29 SQL--SCALE PIC S9(9) COMP.
                       29 SQL--PRECISION PIC S9(9) COMP.
                     29 SQL--STTUS PIC S9(9) COMP.
                 29 SQL--COUNT PIC S9(9) COMP.
                       29 SQL--USERTYPE PIC S9(9) COMP.
                     29 SQL--LOCALE PIC S9(9) COMP.
             19 SD-SQLDATA PIC S9(9) COMP.
             19 SD-SQLIND PIC S9(4) COMP.
             19 SD-SQLLEN PIC S9(9) COMP.
             19 SD-SQLMORE PIC S9(9) COMP.
     01 output-descriptor.
             09 SD-SQLN PIC S9(4) COMP.
             09 SD-SQLD PIC S9(4) COMP.
             09 SD-COLUMN OCCURS 3 TIMES.
              19 SD-DATAFMT.
                 29 SQL--NM PIC X(132).
                 29 SQL--NMLEN PIC S9(9) COMP.
                 29 SQL--DATATYPE PIC S9(9) COMP.
                 29 SQL--FORMAT PIC S9(9) COMP.
                     29 SQL--MAXLENGTH PIC S9(9) COMP.
                     29 SQL--SCALE PIC S9(9) COMP.
                       29 SQL--PRECISION PIC S9(9) COMP.
                     29 SQL--STTUS PIC S9(9) COMP.
                 29 SQL--COUNT PIC S9(9) COMP.
                       29 SQL--USERTYPE PIC S9(9) COMP.
                     29 SQL--LOCALE PIC S9(9) COMP.
             19 SD-SQLDATA PIC S9(9) COMP.
             19 SD-SQLIND PIC S9(4) COMP.
             19 SD-SQLLEN PIC S9(9) COMP.
             19 SD-SQLMORE PIC S9(9) COMP.
    01 conversion-tester pic s9(4) comp-3.
    01 charvar pic x(20).
    01 temp-int-1 pic s9(9) comp.
    01 temp-int-2 pic s9(9) comp.
    01 temp-int-3 pic s9(9) comp.
```

```
    01 temp-int-4 pic s9(9) comp.
    01 SQLCODE pic s9(9) comp.
    01 retcode pic s9(9) comp.
PROCEDURE DIVISION.
P0.
     MOVE "sa" TO uid.
     move" "to pass.
     exec sql connect :uid identified by :pass end-exec.
* setup
     exec sql whenever sqlwarning perform err-paraend-exec.
      exec sql drop table example end-exec.
      exec sql create table example (fruit char(30),
            number int)end-exec.
      exec sql insert example values ('tangerine', 1) end-exec.
      exec sql insert example values ('pomegranate', 2) end-exec.
      exec sql insert example values ('banana', 3) end-exec.
* test functionality using execute
      exec sql prepare statement from
          "select fruit from example where number = ?" end-exec.
      exec sql describe input statement using descriptor
           input-descriptor end-exec.
      if sd-sqld of input-descriptor not equal 1
             or  sql--datatype of sd-datafmt of sd-column  of
             input-descriptor (1) not equal cs-int-type
            display "failed on first describe input"
            move cs-fail to p-retcode
      end-if.
      move 1 to temp-int-1.
      move 4 to temp-int-2.
      move 0 to temp-int-3.
      call "SYBSETSQLDA" using retcode input-descriptor
             temp-int-1 conversion-tester syb-snines-pic
             temp-int-2 temp-int-3 syb-comp3-usage syb-no-sign .
      move 2 to conversion-tester.
      exec sql describe output statement using descriptor
      output-descriptor end-exec.
      if sd-sqld of output-descriptor not equal
             or  sql--datatype of sd-datafmt of sd-column  of
             output-descriptor (1) not equal cs-char-type
             display "failed on first describe output"
            move cs-fail to p-retcode
      end-if.
      move 1 to temp-int-1.
      move 20 to temp-int-2.
      move 0 to temp-int-3.
      call "SYBSETSQLDA" using retcode output-descriptor
```

```
      temp-int-1 charvar syb-x-pic temp-int-2
      temp-int-3 syb-no-usage syb-no-sign .
exec sql execute statement into descriptor
      output-descriptor using descriptor
      input-descriptor end-exec.
display "Expected pomegranate, got "charvar.
exec sql deallocate prepare statement end-exec.
exec sql prepare statement from
      "select number from example where fruit = ?" end-exec.
exec sql declare c cursor for statement end-exec.
exec sql describe input statement using descriptor
      input-descriptor end-exec.
move 1 to temp-int-1.
move 20 to temp-int-2.
move 0 to temp-int-3.
call "SYBSETSQLDA" using retcode input-descriptor
      temp-int-1 charvar syb-x-pic temp-int-2
      temp-int-3 syb-no-usage syb-no-sign .
move "banana" to charvar.
exec sql open c using descriptor input-descriptor end-exec.
exec sql describe output statement using descripto
      output-descriptor end-exec.
move 1 to temp-int-1.
move 20 to temp-int-2.
move 0 to temp-int-3.
call "SYBSETSQLDA" using retcode output-descriptor
     temp-int-1 charvar syb-x-pic temp-int-2 temp-int-3
     syb-no-usage syb-no-sign .
exec sql fetch c into descriptor output-descriptor
      end-exec.
display "Expected 3, got "charvar.
exec sql commit work end-exec.
end program unittest.
```

CHAPTER 8

Handling Errors

This chapter discusses how to detect and correct errors that can occur during the execution of Embedded SQL programs. It covers the whenever and get diagnostics statements, which you can use to process warnings and errors, and the SQLCA variables that pertain to warnings and errors.

While an Embedded SQL application is running, some events may occur that interfere with the application's operation. Following are examples:

- Adaptive Server Enterprise becomes inaccessible.
- The user enters an incorrect password.
- The user does not have access to a database object.
- A database object is deleted.
- A column's datatype changes.
- A query returns an unexpected null value.
- A dynamic SQL statement contains a syntax error.

You can anticipate these events by writing warning and error handling code to recover gracefully when one of these situations occurs.

Testing for errors

Embedded SQL places a return code in the *SQLCODE* variable to indicate the success or failure of each SQL statement sent to Adaptive Server Enterprise. You can either test the value of *SQLCODE* after each Embedded SQL statement or use the whenever statement to instruct the precompiler to write the test code for you. The whenever statement is described later in this chapter.

Using SQLCODE

Table 8-1 lists the values *SQLCODE* can contain:

Table 8-1: SQLCODE return values

Value	Meaning
0	No warnings or errors occurred.
<0	Error occurred and the SQLCA variables contain useful information for diagnosing the error.
100	No rows returned from last statement although the statement executed successfully. This condition is useful for driving a loop that fetches rows from a cursor. When SQLCODE becomes 100, the loop and all rows that have been fetched end. This technique is illustrated in Chapter 6, “Using Transact-SQL Statements.”

Testing for warning conditions

Even when SQLCODE indicates that a statement has executed successfully, a warning condition may still have occurred. The 8-character array SQLCA.SQLWARN indicates such warning conditions. Each SQLWARN array element (or “flag”) stores either the space character (blank) or the character “W”. In each flag, “W” indicates that a warning condition has occurred; the kind of warning condition differs for each flag.

Table 8-2 describes what the space character or “W” means in each flag:

Table 8-2: SQLWARN flags

Flag	Description
SQLWARN1	If blank, no warning condition of any kind occurred, and all other SQLWARN flags are blank. If SQLWARN1 is set to "W," one or more warning conditions occurred, and at least one other flag is set to "W."
SQLWARN2	If set to "W," the character string variable that you designated in a fetch statement was too short to store the statement's result data, so the result data was truncated. You designated no indicator variable to receive the original length of the data that was truncated.
SQLWARN3	If set to "W," the input sent to Adaptive Server Enterprise contained a null value in an illegal context, such as in an expression or as an input value to a table that prohibits null values.
SQLWARN4	The number of columns in a select statement's result set exceeds the number of host variables in the statement's into clause.
SQLWARN5	Reserved.
SQLWARN6	Adaptive Server generated a conversion error while attempting to execute this statement.
SQLWARN7	Reserved.
SQLWARN8	Reserved.

Test for a warning after you determine that a SQL statement executed successfully. Use the whenever statement, as described in the next section, to instruct the precompiler to write the test code for you.

Trapping errors with the *whenever* statement

Use the Embedded SQL whenever statement to trap errors and warning conditions. It specifies actions to be taken depending on the outcome of each Embedded SQL statement sent to Adaptive Server Enterprise.

The whenever statement is not executable. Instead, it directs the precompiler to generate COBOL code that tests for specified conditions after each executable Embedded SQL statement in the program.

The syntax of the whenever statement is:

```
exec sql whenever {sqlwarning | sqlerror |
```

```
not found ]
{continue | goto label |
program call [using param . . .]) |
perform paragraph_1 [through paragraph_2] |
stop};
```

whenever testing conditions

Each whenever statement can test for one of the following three conditions:

- sqlwarning
- sqlerror
- not found

The precompiler generates warning messages if you do not write a whenever statement for each condition. If you write your own code to check for errors and warnings, suppress the precompiler warnings by writing a whenever...continue clause for each condition. This instructs the precompiler to ignore errors and warnings.

If you precompile with the verbose option, the precompiler generates a ct_debug() function call as part of each connect statement. This causes Client-Library to display informational, warning, and error messages to your screen as your application runs. The whenever statement does not disable these messages. See the *Open Client and Open Server Programmers Supplement*.

After an Embedded SQL statement executes, the values of SQLCODE and SQLWARN1 determine if one of the conditions exists. Table 8-3 shows the criteria whenever uses to detect the conditions:

Table 8-3: Criteria for the whenever statement

Condition	Criteria
sqlwarning	SQLCODE = 0 and SQLWARN1 = W
sqlerror	SQLCODE < 0
not found	SQLCODE = 100

To change the action of a whenever statement, write a new whenever statement for the same condition. whenever applies to all Embedded SQL statements that follow it, up to the next whenever statement for the same condition.

The whenever statement ignores the application program's logic. For example, if you place whenever at the end of a loop, it does not affect the preceding statements in subsequent passes through the loop.

whenever actions

The whenever statement specifies one of the following five actions:

Table 8-4: whenever actions

Action	Description
continue	Causes no special action when a SQL statement returns the specified condition. Normal processing continues.
goto	Causes a branch to an error-handling procedure within your application program. You can enter goto as either “goto” or “go to”, followed by a valid paragraph name. The precompiler does not detect an error if the paragraph name is not defined in the program, but the COBOL compiler does.
call	Calls another COBOL program and, optionally, passes variables.
perform	Names at least one paragraph to execute when a SQL statement results in the specified condition. You can use the COBOL perform statement formats 1, 2, 3, and 4 in the perform clause. If you use a paragraph name, the paragraph must be in the section where the whenever condition applies.
stop	Terminates the program when a SQL statement triggers the specified condition.

```
       . . .
exec SQL whenever sqlerror perform ERR-PARA
          thru ERR-PARA-END
end-exec
       . . .
exec SQL select au_lname from authors
        into :AU-LNAME
        where au_id = :AU-ID
        end-exec
       . . .
exec SQL update authors set au_lname = :AU-LNAME
        where au_id = :AU-ID
end-exec
       . . .
```

Using *get diagnostics*

The get diagnostics statement retrieves error, warning, and informational messages from Client-Library. It is similar to— but more powerful than—the whenever statement because you can expand it to retrieve more details of the detected errors.

If, within a whenever statement, you specify the application to go to or call another application or paragraph, specify get diagnostics in the procedure code, as follows:

```
err-handler.
 exec sql get diagnostics :num-msgs = number
 end-exec.
 perform varying condcnt from 0 by 1
 until condcnt greater or equal num-msgs
 exec sql get diagnostics exception :condcnt
     :sqlca = sqlca_info end-exec
     display "sqlcode is " sqlcode
     display "message text is " sqlerrmc
 end-perform.
```

Writing routines to handle warnings and errors

A good strategy for handling errors and warnings in an Embedded SQL application is to write custom procedures to handle them, then install the procedures with the whenever...perform statement.

The following example shows sample warning and error handling routines. For simplicity, both routines omit certain conditions that should normally be included: warn_para omits the code for SQLWARN1, and err_para omits the code that handles Client-Library errors and operating system errors:

```
* Declare the sqlca.  *
 exec sql include sqlca end-exec
 exec sql whenever sqlerror call "ERR-PARA"
     end-exec
 exec sql whenever sqlwarning call
     "WARN-PARA" end-exec
 exec sql whenever not found continue end-exec

 WARN-PARA.
 *    Displays error codes and numbers from the sqlca
```

```
*    and exits with an ERREXIT status.

   DISPLAY "Warning code is " SQLCODE.
    DISPLAY "Warning message is " SQLERRMC.

   IF SQLWARN2 EQUAL "W"
        DISPLAY "Data has been truncated.".
    IF SQLWARN3 EQUAL "W"
        DISPLAY "A null value was eliminated from
-        "    the argument set of a function.".
    IF SQLWARN4 EQUAL "W"
        DISPLAY "An into clause had too many or too
-        "    few host variables.".
    IF SQLWARN5 EQUAL "W"
        DISPLAY "A dynamic update or delete was
-        "    lacking a where clause.".
    IF SQLWARN6 EQUAL "W"
        DISPLAY "A server conversion or truncation
-        "    error occurred.".
WARN-PARA-END.
    EXIT.

ERR-PARA.
* Print the error code, the error message, and the
* line number of the command that caused the
* error.

   DISPLAY "Error code is " SQLCODE.
    DISPLAY "Error message is " SQLERRMC.
    STOP RUN.
```

Precompiler-detected errors

The Embedded SQL precompiler detects Embedded SQL errors at precompile time. The precompiler detects syntax errors such as missing semicolons and undeclared host variables in SQL statements. These are severe errors, so appropriate error messages are generated.

You can also have the precompiler check Transact-SQL syntax errors. Adaptive Server Enterprise parses Transact-SQL statements at precompile time if the appropriate precompiler command options are set. See the precompiler reference page in the *Open Client and Open Server Programmers Supplement*.

The precompiler substitutes host variables in Embedded SQL statements with dynamic parameter markers (“?”). Occasionally, substituting host variables with parameter markers causes syntax errors (for example, when rules or triggers do not allow the parameters).

The precompiler does not detect the error in the following example, in which a table is created and data is selected from it. The error is that the host variables’ datatypes do not match the columns retrieved. The precompiler does not detect the error because the table does not yet exist when the precompiler parses the statements:

```
exec sql begin declare section end-exec
          01  VAR1           PIC S9(9) COMP.
          02  VAR2           PIC X(20).
          exec sql end declare section end-exec

          exec sql create table T1
            (col1 int, col2 varchar(20)) end-exec
          ...

          exec sql select * from T1 into
         :VAR2, :VAR1 end-exec.
```

Note that the error will be detected and reported at runtime.

CHAPTER 9

Embedded SQL Statements: Reference Pages

This chapter consists of a reference page for each Embedded SQL statement that either does not exist in Transact-SQL or works differently from the way it works in Transact-SQL. Refer to the *Adaptive Server Enterprise Transact-SQL Users Guide* for descriptions of all other Transact-SQL statements that are valid in Embedded SQL.

Except for print, raiserror, readtext, and writetext, all Transact-SQL statements can be used in Embedded SQL, although the syntax of some statements differs, as described in this chapter.

The reference pages in this chapter are arranged alphabetically. Each statement’s reference page:

- Briefly states what the statement does
- Describes the statement’s syntax
- Explains the statement’s keywords and options
- Comments on the statement’s proper use
- Lists related statements, if any
- Demonstrates the statement’s use in a brief example

allocate descriptor

Description

Allocates a SQL descriptor.

Syntax

exec sql allocate descriptor *descriptor_name*
[with max [*host_variable* | *integer_literal*]]
end-exec

Parameters

descriptor_name
The name of the SQL descriptor that will contain information about the dynamic parameter markers in a prepared statement.

with max
The maximum number of columns in the SQL descriptor.

host_variable
An integer host variable defined in a declare section.

integer_literal
A numeric value representing the size, in number of occurrences, of the SQL descriptor.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
                01    COLTYPE           PIC S9(9) COMP.
                01    NUMCOLS           PIC S9(9) COMP.
                01    COLNUM            PIC S9(9) COMP.
    EXEC SQL END DECLARE SECTION END-EXEC.

               ...

    EXEC SQL ALLOCATE DESCRIPTOR big_desc WITH MAX 1000 END-EXEC.

    EXEC SQL PREPARE dynstmt FROM "select * from huge_table" END-EXEC.

   *  Assume that the select returns only 1 row.
    EXEC SQL EXECUTE dynstmt INTO SQL DESCRIPTOR big_desc END-EXEC.

    EXEC SQL GET DESCRIPTOR big_desc :NUMCOLS = COUNT END-EXEC.

    MOVE 1 TO COLNUM.
    PERFORM GET-DESC-LOOP UNTIL COLNUM  > NUMCOLS.

    EXEC SQL DEALLOCATE DESCRIPTOR big_desc END-EXEC.
    EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
        ...

    GET-DESC-LOOP.
```

```
EXEC SQL GET DESCRIPTOR big_desc VALUE
        :COLNUM :COLTYPE = TYPE END-EXEC.
DISPLAY "COLUMN ",COLNUM," IS OF TYPE ", COLTYPE.
ADD 1 TO COLNUM.
```

Usage

- The allocate descriptor command specifies the number of item descriptor areas that Adaptive Server Enterprise allocates.
- You can allocate any number of SQL descriptors.
- When a SQL descriptor is allocated, its fields are undefined.
- If you try to allocate a SQL descriptor that is already allocated, an error occurs.
- If you do not specify a value for the with max clause, one item descriptor is assigned.
- When a SQL descriptor is allocated, the value of each of its fields is undefined.

See also

deallocate descriptor, get descriptor, set descriptor

begin declare section

Description

Begins a declare section, which declares host language variables used in an Embedded SQL source file.

Syntax

exec sql begin declare section end-exec
host_variable_declaration.
...
exec sql end declare section end-exec

Parameters

host_variable_declaration
The declaration of one or more host language variables.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
                01 TITLE PIC X(80).
                01 VAR1PIC S9(9) COMP.
                01 VAR2 PIC X(100).
 EXEC SQL END DECLARE SECTION END-EXEC.
```

Usage

- A declare section must end with the Embedded SQL statement end declare section.
- A source file can have any number of declare sections.

- declare sections can be placed anywhere that variables can be declared. The declare section that declares a variable must precede any statement that references the variable.
- Variable declarations in a declare section must conform to the rules of the host language.
- Nested structures are valid in a declare section; arrays of structures are not.
- A declare section can contain any number of Embedded SQL include statements.
- When processing Embedded SQL include statements within a declare section, the Embedded SQL precompiler treats the contents of the included file as though had been entered directly into the file being precompiled.

See also exec sql include "filename"

begin transaction

Description Marks the starting point of an unchained transaction.

Syntax
```
exec sql [at connection_name]
 begin {transaction | tran} [transaction_name]
 end-exec
```

Parameters

transaction | tran
The keywords transaction and tran are interchangeable.

transaction_name
The name that you are assigning to this transaction. The name must conform to the rules for Transact-SQL identifiers.

Examples

```
      *
       * Use explicit transactions to synchronize tables on
       * two servers.
       *

          EXEC SQL BEGIN DECLARE SECTION END-EXEC.
               01     TITLE-ID     PIC X(6).
               01     NUM-SOLD     PIX S9(9) COMP.
          EXEC SQL END DECLARE SECTION END-EXEC.
```

```
      ...

EXEC SQL WHENEVER SQLERROR PERFORM ABORT-TRAN END-EXEC.

   EXEC SQL CONNECT :UID IDENTIFIED BY :PASS
                           AT connect1  END-EXEC.
   EXEC SQL CONNECT :UID IDENTIFIED BY :PASS
                           AT connect2 END-EXEC.

PERFORM TRY-UPDATE.

TRY-UPDATE.
EXEC SQL AT connect1 BEGIN TRANSACTION END-EXEC.
EXEC SQL AT connect2 BEGIN TRANSACTION END-EXEC.

EXEC SQL AT connect1 SELECT  sum(qty) INTO :NUM-SOLD
      FROM salesdetail
      WHERE title_id = :TITLE-ID END-EXEC.

EXEC SQL AT connect2 UPDATE current_sales
      SET num_sold = :NUM-SOLD
      WHERE title_id = :TITLE-ID END-EXEC.

EXEC SQL AT connect2 COMMIT TRANSACTION END-EXEC.
EXEC SQL AT connect1 COMMIT TRANSACTION END-EXEC.

IF SQLCODE <> 0
     DISPLAY "OOPS! Should have used 2-phase commit".


ABORT-TRAN.
EXEC SQL WHENEVER SQLERROR CONTINUE END-EXEC.
   DISPLAY "Error code is " SQLCODE.
   DISPLAY "Error message is " SQLERRMC.
EXEC SQL AT connect2 ROLLBACK TRANSACTION END-EXEC.
EXEC SQL AT connect1 ROLLBACK TRANSACTION END-EXEC.
PERFORM TRY-UPDATE.
```

Usage

- This reference page describes aspects of the Transact-SQL begin transaction statement that differ when used with Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- The begin transaction statement is valid only in unchained transaction mode. In chained transaction mode, you cannot explicitly mark the starting point of a transaction.

- When nesting transactions, assign a transaction name only to the outermost begin transaction statement and its corresponding commit transaction or rollback transaction statement.
- Unless you set the database option ddl in tran, Adaptive Server Enterprise does not allow the following statements inside an unchained transaction: create database, create table, create index, create view, drop statements, select into *table_name*, grant, revoke, alter database, alter table, truncate table, update statistics, load database, load transaction, and disk init.
- A transaction includes only statements that execute on the connection that is current when the transaction begins.
- Remote procedures execute independently of any transaction in which they are included.

See also commit transaction, commit work, rollback transaction, rollback work

close

Description Closes an open cursor.

Syntax exec sql [at *connection_name*] close *cursor_name*
end-exec

Parameters *cursor_name*
The name of the cursor to be closed; that is, the name that you assigned when declaring the cursor.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     LNAME     PIC X(40).
      01     FNAME   PIC X(20).
      01     PHONE   PIC X(12).
 EXEC SQL END DECLARE SECTION END-EXEC.

           ...

 EXEC SQL DECLARE authorlist CURSOR FOR
       SELECT au_lname, au_fname, phone
       FROM authors END-EXEC.

 EXEC SQL OPEN authorlist END-EXEC.
 PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
```

```
EXEC SQL CLOSE authorlist END-EXEC,
          ...


FETCH-LOOP.
     EXEC SQL FETCH authorlist INTO
          :LNAME, :FNAME, :PHONE END-EXEC.
     DISPLAY LNAME, FNAME, PHONE.
```

Usage

- The close statement closes an open cursor. Unfetched rows are canceled.
- Reopening a closed cursor executes the associated query again, positioning the cursor pointer before the first row of the result set.
- A cursor must be closed before it is reopened.
- Attempting to close a cursor that is not open causes a runtime error.
- The commit transaction, rollback transaction, commit work, and rollback work statements close a cursor automatically unless you set a precompiler option to disable the feature.
- Closing and then reopening a cursor lets your program see any changes in the tables from which the cursor retrieves rows.

See also declare cursor, fetch, open, prepare

commit

Description Ends a transaction, preserving changes made to the database during the transaction.

Syntax

exec sql [at *connection_name*]
 commit [transaction | tran | work]
 [*transaction_name*] end-exec

Parameters

transaction | trans | work

The keywords transaction, trans, and work are interchangeable in the rollback statement, except that only work is ANSI-compliant.

transaction_name

A name assigned to the transaction.

Examples

Example 1

```
* Using unchained transaction mode to
     * synchronize tables on two servers.
     *
      EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     TITLE-ID     PIC X(7).
           01     NUM-SOLD       PIC S9(9).
      EXEC SQL END DECLARE SECTION END-EXEC.

            ...

         EXEC SQL CONNECT :UID IDENTIFIED BY :PASS
                                 AT connect1  END-EXEC.
         EXEC SQL CONNECT :UID IDENTIFIED BY :PASS
                                 AT connect2 END-EXEC.

            ...

      PERFORM TRY-UPDATE.

      TRY-UPDATE.
      EXEC SQL AT connect1 BEGIN TRANSACTION END-EXEC.
      EXEC SQL AT connect2 BEGIN TRANSACTION END-EXEC.

      EXEC SQL AT connect1 SELECT sum(qty) INTO :NUM-SOLD
            FROM salesdetail
            WHERE title_id = :TITLE-ID END-EXEC.

      EXEC SQL AT connect2 UPDATE current_sales
            SET num_sold = :NUM-SOLD
            WHERE title_id = :TITLE-ID END-EXEC.

      EXEC SQL AT connect2 COMMIT TRANSACTION END-EXEC.

      EXEC SQL AT connect1 COMMIT TRANSACTION END-EXEC.

      IF SQLCODE <> 0
           DISPLAY "Oops! Should have used 2-phase commit".
```

Example 2

```
      * Using chained transaction mode to synchronize
      * tables on two servers.


      EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     TITLE-ID     PIC X(7).
           01     NUM-SOLD     PIX S9(9) COMP.
      EXEC SQL END DECLARE SECTION END-EXEC.
```

```
      ...

EXEC SQL WHENEVER SQLERROR PERFORM ABORT-TRAN END-EXEC.

PERFORM TRY-UPDATE.

TRY-UPDATE.
EXEC SQL AT connect1 SELECT sum(qty) INTO :NUM-SOLD
      FROM salesdetail
      WHERE title_id = :TITLE-ID END-EXEC.

EXEC SQL AT connect2 UPDATE current_sales
      SET num_sold = :NUM-SOLD
      WHERE title_id = :TITLE-ID END-EXEC.

EXEC SQL AT connect2 COMMIT WORK END-EXEC.
EXEC SQL AT connect1 COMMIT WORK END-EXEC.

IF SQLCODE <> 0
     DISPLAY "OOPS! Should have used 2-phase commit".


ABORT-TRAN.
   DISPLAY "ERROR! ABORTING TRAN".
   DISPLAY "Error code is " SQLCODE.
   DISPLAY "Error message is " SQLERRMC.
EXEC SQL WHENEVER SQLERROR CONTINUE END-EXEC.
EXEC SQL AT connect2 ROLLBACK WORK END-EXEC.
EXEC SQL AT connect1 ROLLBACK WORK END-EXEC.
PERFORM TRY-UPDATE.
```

Usage

- This reference page mainly describes aspects of the Transact-SQL commit statement that differ when used with Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- Transaction names must conform to the Transact-SQL rules for identifiers. Transaction names are a Transact-SQL extension: they cannot be used with the ANSI-compliant keyword work.
- When nesting transactions, assign a transaction name only to the outermost begin transaction statement and its corresponding commit transaction or rollback transaction statement.

See also

begin transaction, commit work, rollback transaction, rollback work

connect

Description

Creates a connection to Adaptive Server Enterprise.

Syntax

exec sql connect *user_name*
[identified by *password*] [at *connection_name*]
[using *server_name*] [labelname *label_name* labelvalue *label_value* ...] end-exec

Parameters

user_name
The user name to be used when logging into Adaptive Server Enterprise.

password
The password to use to log in to Adaptive Server Enterprise.

connection_name
A name that you choose to uniquely identify the Adaptive Server Enterprise connection.

server_name
The server name of the Adaptive Server Enterprise to which you are connecting.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01          UID              PIC X(32).
      01          PASS             PIC X(32).
      01          SERVER           PIC X(100).
 EXEC SQL END DECLARE SECTION END-EXEC.


 DISPLAY "UID NAME?".
 ACCEPT UID.
 DISPLAY "PASSWORD ?".
 ACCEPT PASS.
 DISPLAY "SERVER TO CONNECT TO ?".
 ACCEPT SERVER.

 EXEC SQL CONNECT :UID IDENTIFIED BY :PASS
           USING :SERVER END-EXEC.
```

Usage

- In every Embedded SQL program, the connect statement must be executed before any other executable SQL statement except allocate descriptor.
- The *label_name* and *label_value* clauses, if used, must be the last clauses of the connect statement.
- If a program uses both C and COBOL languages, the first connect statement must be issued from a COBOL program.

- If a program has multiple connections, only one can be unnamed.
- If an Embedded SQL statement does not have an at *connection_name* clause to direct it to a specific named connection, the statement is executed on the current connection.
- To specify a null password, omit the identified by clause or use an empty string.
- If the connect statement does not specify an Adaptive Server Enterprise, the server named by the DSQUERY environment variable or logical name is used. If DSQUERY is not defined, the default server is SYBASE.
- Client-Library looks up the server name in the interfaces file located in the directory specified by the SYBASE environment variable or logical name.
- The Adaptive Server Enterprise connection ends when the Embedded SQL program exits or issues a disconnect statement.
- Opening a new connection, named or unnamed, results in the new connection becoming the current connection.
- A program that requires multiple Adaptive Server Enterprise login names can have a connection for each login account.
- By connecting to more than one server, a program can simultaneously access data stored on different servers.
- A single program can have multiple connections to a single server or multiple connections to different servers.
- Table 9-1 shows how a connection is named:

Table 9-1: How a connection is named

If this clause is used	But without	Then, the ConnectionName is
at *connection_name*		*connection_name*
using *server_name*	at	*server_name*
None		DEFAULT

See also

at connection_name, exec sql, disconnect, set connection

deallocate cursor

Description — Deallocates a cursor for a static SQL statement or for a dynamic SQL statement.

Syntax — exec sql [at *connection_name*] deallocate cursor *cursor_name* end-exec

Parameters

cursor_name
The name of the cursor to be deallocated. The *cursor_name* must be a character string enclosed in double quotation marks or in no quotation marks—for example "*my_cursor*" or *my_cursor*. It cannot be a host variable.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
            01     TITLE-ID     PIC X(7).
            01     BOOK-NAME      PIC X(80).
            01     TTYPE          PIC X(12).
            01     TITLE-INDIC      S9(9).
            01     TYPE-INDIC       S9(9).
       EXEC SQL END DECLARE SECTION END-EXEC.

            ...

       EXEC SQL DECLARE titlelist CURSOR FOR
             SELECT type, title_id, title FROM titles
                 order by type END-EXEC.

       EXEC SQL OPEN titlelist END-EXEC.

       PERFORM FETCH-PARA UNTIL SQLCODE = 100.

       EXEC SQL CLOSE titlelist END-EXEC.
       EXEC SQL DEALLOCATE CURSOR titlelist END-EXEC.
            ...


       FETCH-PARA.
            EXEC SQL FETCH titlelist INTO
                 :TTYPE      :TYPE-INDIC,
                 :TITLE-ID,
                 :BOOK-NAME     :TITLE-INDIC  END-EXEC.

            IF TYPE-INDIC <> -1
                 DISPLAY "TYPE      : ", TTYPE
            ELSE
                 DISPLAY "TYPE      : UNDECIDED"
```

```
            END-IF.

            DISPLAY "TITLE ID : ",TITLE-ID.

            IF TITLE-INDIC <> -1
                 DISPLAY "TITLE     : ", BOOK-NAME
            ELSE
                 DISPLAY "TITLE     : Null value"
            END-IF.
       END-FETCH-PARA.
```

Usage

- Deallocating a cursor releases all resources allocated to the cursor. In particular, deallocate cursor drops the Client-Library command handle and CS_COMMAND structure associated with the cursor.
- A static cursor can be deallocated at any time after it is opened. A dynamic cursor can be deallocated at any time after it is declared.
- If *cursor_name* is open, deallocate cursor closes it and then deallocates it.
- You cannot reference a deallocated cursor, nor can you reopen it. If you try, an error occurs.
- You can declare a new cursor having the same name as that of a deallocated cursor. Opening a cursor with the same name as a deallocated cursor is not the same as reopening the deallocated cursor. Other than the name, the new cursor shares nothing with the deallocated cursor.
- Declaring a new cursor with the same name as that of a deallocated cursor can cause the precompiler to generate a warning message.
- The deallocate cursor statement is a Sybase extension; it is not defined in the SQL standard.

Note If you are using persistent binding in your Embedded SQL program, use the deallocate cursor statement carefully. Needlessly deallocating cursors can negate the advantage of persistent binding.

See also close cursor, declare cursor, open (static cursor)

deallocate descriptor

Description Deallocates a SQL descriptor.

Syntax

exec sql deallocate descriptor *descriptor_name*
end-exec

Parameters

descriptor_name
The name of the SQL descriptor that contains information about the dynamic parameter markers or return values in a prepared statement.

Examples

```
        EXEC SQL BEGIN DECLARE SECTION END-EXEC.
              01     NUMCOLS        PIC S9(9) COMP.
              01     COLNUM         PIC S9(9) COMP.
              01     COLTYPE        PIC S9(9) COMP.
         EXEC SQL END DECLARE SECTION END-EXEC.

                 ...

         EXEC SQL ALLOCATE DESCRIPTOR big_desc WITH MAX 100 END-EXEC.
         EXEC SQL PREPARE dynstmt FROM "select * from huge_table" END-EXEC.

      * Assume that only one row of data is returned.
         EXEC SQL EXECUTE dynstmt INTO SQL DESCRIPTOR big_desc END-EXEC.
         EXEC SQL GET DESCRIPTOR big_desc :NUMCOLS = COUNT END-EXEC.

         MOVE 1 TO COLNUM.
         PERFORM GET-DESC-LOOP UNTIL COLNUM > NUMCOLS.

         EXEC SQL DEALLOCATE DESCRIPTOR big_desc END-EXEC.

                ...


         GET-DESC-LOOP.
         EXEC SQL GET DESCRIPTOR big_desc VALUE
                   :COLNUM :COLTYPE = TYPE END-EXEC.
         DISPLAY "COLUMN TYPE = ",COLTYPE.
         ADD 1 TO COLNUM.
```

Usage

- If you attempt to deallocate a SQL descriptor that has not been allocated, an error occurs.

See also

allocate descriptor

deallocate prepare

Description

Deallocates a dynamic SQL statement that was prepared in a prepare statement.

Syntax

exec sql [at *connection_name*]
deallocate prepare *statement_name* end-exec

Parameters

statement_name

The identifier assigned to the dynamic SQL statement when the statement was prepared.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     CMDBUF          PIC X(120).
      01     STATE           PIC X(3).
 EXEC SQL END DECLARE SECTION END-EXEC.

          ...

* The 'select into table' statement returns no results
* to the program, so it does not need a cursor.

   MOVE "select * into tmp from authors where state = ?"
             TO CMDBUF.

   DISPLAY "STATE ? ".
   ACCEPT STATE.

   EXEC SQL PREPARE dynstmt FROM :CMDBUF END-EXEC.
   EXEC SQL EXECUTE dynstmt USING :STATE END-EXEC.

   EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
   EXEC SQL COMMIT WORK END-EXEC.
```

Usage

- A statement must be prepared before it is deallocated. Attempting to deallocate a statement that has not been prepared results in an error.
- *statement_name* must uniquely identify a statement buffer and must conform to the SQL identifier rules for naming variables. *statement_name* can be either a literal or a character array host variable.

- The deallocate prepare statement closes and deallocates any dynamic cursors declared for *statement_name.*

Warning! If you are using persistent binds in your Embedded SQL program, use the deallocate prepare statement carefully. Needlessly deallocating prepared statements can negate the advantage of persistent binds.

See also declare cursor (dynamic), execute, execute immediate, prepare

declare cursor (dynamic)

Description Declares a cursor for processing multiple rows returned by a prepared dynamic select statement.

Syntax
exec sql [at *connection_name*]
declare *cursor_name*
cursor for *prepped_statement_name* end-exec

Parameters

cursor_name
The cursor's name, used to reference the cursor in open, fetch, and close statements. A cursor's name must be unique on each connection and must have no more than 255 characters.

prepped_statement_name
The name (specified in a previous prepare statement) that represents the select statement to be executed.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC

       01      QUERY       PIC X(100).
       01      DATAVAL     PIC X(100).
       01      COUNTER     PIC S9(9) COMP.
       01      NUMCOLS     PIC S9(9) COMP.
       01      COLNAME     PIC X(32).
       01      COLTYPE     PIC S9(9) COMP.
       01      COLLEN      PIC S9(9) COMP.

  EXEC SQL END DECLARE SECTION END-EXEC.
               ...
  EXEC SQL WHENEVER SQLERROR PERFORM ERR-PARA END-EXEC.
  EXEC SQL WHENEVER SQLWARNING PERFORM WARN-PARA END-EXEC
```

```
      EXEC SQL WHENEVER NOT FOUND STOP END-EXEC.
                    ...
   EXEC SQL USE pubs2 END-EXEC.
   MOVE "SELECT * FROM publishers " TO QUERY.
   EXEC SQL ALLOCATE DESCRIPTOR dout WITH MAX 100 END-EXEC.
   EXEC SQL PREPARE  dynstmt FROM :QUERY END-EXEC.
   EXEC SQL DECLARE dyncur CURSOR FOR dynstmt END-EXEC.
   EXEC SQL OPEN dyncur END-EXEC.
   PERFORM FETCH-LOOP UNTIL SQLCODE  = 100.

* Clean-up all open cursors, descriptors and dynamic statements.

   EXEC SQL CLOSE dyncur END-EXEC.
   EXEC SQL DEALLOCATE CURSOR dyncur END-EXEC.
   EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
   EXEC SQL DEALLOCATE DESCRIPTOR dout END-EXEC.
   EXEC SQL COMMIT WORK END-EXEC.

   STOP RUN.

    FETCH-LOOP.
          EXEC SQL FETCH dyncur INTO SQL DESCRIPTOR dout END-EXEC
          EXEC SQL GET DESCRIPTOR dout :NUMCOLS = COUNT END-EXEC
          DISPLAY "COLS = ", NUMCOLS
          MOVE 1 TO COUNTER
          PERFORM GET-DESC-PARA UNTIL  COUNTER > NUMCOLS.
    END-FETCH-LOOP.

     GET-DESC-PARA.
           EXEC SQL GET DESCRIPTOR dout VALUE :COUNTER
                           :COLNAME = NAME,
                           :COLTYPE = TYPE,
                           :COLLEN  = LENGTH
                       END-EXEC
           DISPLAY "NAME      :", COLNAME
           DISPLAY "TYPE      :", COLTYPE
           DISPLAY "LENGTH    :", COLLEN

           EXEC SQL GET DESCRIPTOR dout VALUE :COUNTER
                           :DATAVAL = DATA END-EXEC
           DISPLAY "DATA      :", DATAVAL
           DISPLAY " "
           ADD 1 TO COUNTER.
    END-GET-DESC-PARA.
```

Usage

- The *prepped_statement_name* must not have a compute clause.

- The *cursor_name* must be declared on the connection where *prepped_statement_name* was prepared.
- The dynamic declare cursor statement is an executable statement, whereas the static declare cursor statement is simply a declaration. The dynamic declare statement must be located where the host language allows executable statements and the program should check return codes (SQLCODE, SQLCA, or SQLSTATE).
- The for update and read only clauses for a dynamic cursor are not part of the declare cursor statement but rather should be included in the prepared statement's select query.

See also close, connect, fetch, open, prepare

declare cursor (static)

Description Declares a cursor for processing multiple rows returned by a select statement.

Syntax
```
exec sql declare cursor_name
 cursor for select_statement
 [for update [of col_name_1 [, col_name_n]…]|
 for read only] end-exec
```

Parameters

cursor_name
The cursor's name, used to reference the cursor in open, fetch, and close statements. A cursor's name must be unique on each connection and must have no more than 255 characters.

select_statement
The Transact-SQL select statement to be executed when the cursor is opened. See the description of the select statement in the *Adaptive Server Enterprise Reference Manual*.

for update
Specifies that the cursor's result list can be updated. (To update the result list, you use the update statement.

of *col_name_n*
The name of a column to be updated.

for read only
Specifies that the cursor's result list cannot be updated.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     TITLE-ID      PIC X(6).
      01     BOOK-NAME         PIC X(25).
      01     TYPE           PIC X(15).
 EXEC SQL END DECLARE SECTION END-EXEC.

      01      ANSWER           PIC X(1).

      ....


 DISPLAY "TYPE OF BOOKS TO RETRIEVE ? ".
 ACCEPT BOOK-TYPE.
 EXEC SQL DECLARE titlelist CURSOR FOR
      SELECT title_id, substring(title,1,25) FROM
           titles WHERE type = :BOOK-TYPE END-EXEC.

 EXEC SQL OPEN titlelist END-EXEC.
 PERFORM FETCH-PARA UNTIL SQLCODE = 100.
 EXEC SQL CLOSE titlelist END-EXEC.
 EXEC SQL DEALLOCATE CURSOR titlelist END-EXEC.
 EXEC SQL COMMIT WORK END-EXEC.


 FETCH-PARA.
      EXEC SQL FETCH titlelist INTO
                :TITLE-ID, :BOOK-NAME END-EXEC.
      DISPLAY "TITLE ID : ",TITLE-ID
      DISPLAY "TITLE    : ",BOOK-NAME
      IF SQLCODE = 100
           DISPLAY "NO RECORDS TO FETCH. END OF PROGRAM RUN."
      ELSE
      DISPLAY "UPDATE/DELETE THIS RECORD (U/D)? "
      ACCEPT ANSWER.

      IF ANSWER = "U"
           DISPLAY "ENTER NEW TITLE :"
           ACCEPT BOOK-NAME
           EXEC SQL UPDATE titles SET title = :BOOK-NAME
                 WHERE CURRENT OF titlelist END-EXEC
      ELSE
           IF ANSWER = "D"
                EXEC SQL DELETE titles
                WHERE CURRENT OF titlelist  END-EXEC
           END-IF
```

```
            END-IF
            END-IF.
        END-FETCH-PARA.
```

Usage

- The Embedded SQL precompiler generates no code for the declare cursor statement.
- The select_statement does not execute until your program opens the cursor by using the open cursor statement.
- The syntax of the select_statement is identical to that shown in the *Adaptive Server Enterprise Reference Manual*, except that you cannot use the compute clause in Embedded SQL.
- The select_statement can contain host variables. The values of the host variables are substituted when your program opens the cursor.
- If you omit either the for update or read only clause, Adaptive Server Enterprise determines whether the cursor is updatable.

See also

close, connect, deallocate cursor, declare cursor (stored procedure), declare cursor (dynamic), fetch, open, update

declare cursor (stored procedure)

Description

Declares a cursor for a stored procedure.

Syntax

exec sql declare *cursor_name*
cursor for execute *procedure_name*
([[@*param_name* =]:*host_var*]
[,[@*param_name* =]:*host_var*]…) end-exec

Parameters

cursor_name
The cursor's name, used to reference the cursor in open, fetch, and close statements. A cursor's name must be unique on each connection and must have no more than 255 characters.

procedure_name
The name of the stored procedure to be executed.

param_name
The name of a parameter in the stored procedure.

host_var
The name of a host variable to be passed as a parameter value.

Examples

```
 EXEC SQL BEGIN DECLARE SECTION END-EXEC.
       01        TITLE-ID      PIC X(6).
       01        BOOK-NAME     PIC X(65).
       01        BOOK-TYPE     PIC X(15).
  EXEC SQL END DECLARE SECTION END-EXEC.

       01        ANSWER        PIC X(1).

       ....

*  Create the stored procedure.

  EXEC SQL create procedure p_titles (@p_type varchar(30))
        as
            select title_id, substring(title,1,64)
                  from titles
                 where type = @p_type
  END-EXEC.

 * To execute stored procedures, you must disable chained mode.
  EXEC SQL SET CHAINED OFF END-EXEC.

  DISPLAY "TYPE OF BOOKS TO RETRIEVE ? ".
  ACCEPT BOOK-TYPE.
  EXEC SQL DECLARE titlelist CURSOR FOR
             execute p_titles :BOOK-TYPE END-EXEC.
  EXEC SQL OPEN titlelist END-EXEC.
  PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
  EXEC SQL CLOSE titlelist END-EXEC.
  EXEC SQL DEALLOCATE CURSOR titlelist END-EXEC.
  EXEC SQL COMMIT WORK END-EXEC.

  FETCH-LOOP.
       EXEC SQL FETCH titlelist INTO
            :TITLE-ID, :BOOK-NAME END-EXEC
       DISPLAY "TITLE ID : ", TITLE-ID
       DISPLAY "TITLE    : ", BOOK-NAME
       IF SQLCODE = 100
            DISPLAY "NO RECORDS TO FETCH. END OF PROGRAM RUN."
       ELSE
               DISPLAY "UPDATE/DELETE THIS RECORD ? "
               ACCEPT ANSWER

               IF ANSWER = "U"
                    DISPLAY "ENTER NEW TITLE :"
```

```
                    ACCEPT BOOK-NAME
                    EXEC SQL UPDATE titles SET title = :BOOK-NAME
                  WHERE CURRENT OF titlelist END-EXEC.
               ELSE
               IF ANSWER = "D"
                    EXEC SQL DELETE titles WHERE CURRENT OF
                        titlelist  END-EXEC
               END-IF
          END-IF.
          END-IF.
```

Usage

- *procedure_name* must consist of only one select statement.
- It is not possible to retrieve output parameter values from a stored procedure executed using a cursor.
- It is not possible to retrieve the return status value of a stored procedure executed using a cursor.

See also

close, deallocate cursor, declare cursor (static), declare cursor (dynamic), fetch, open, update

declare scrollable cursor

Description

Declares a scrollable cursor.

Syntax

EXEC SQL DECLARE <curs_name>
[<*cursor sensitivity*>]
[<*cursor scrollability*>] CURSOR
FOR <cursor specification>
<*cursor sensitivity*> : : =
SEMI_SENSITIVE
| INSENSITIVE
<*cursor scrollability*> : : =
SCROLL
| NO SCROLL
<cursor specification> : : =
<select statement> [<updatability clause>]
<updatability clause> : : =
FOR {READ ONLY | UPDATE [OF <column name list>]}
END-EXEC

Parameters

cursor sensitivity

Declares a cursor semi-sensitive or insensitive.

cursor scrollability
Declares a cursor scrollable or non-scrollable.

Note A scrollable cursor does not use fetch loops but rather single fetch calls. Only non-scrollable and forward-only cursors use fetch loops.

Examples

```
EXEC SQL DECLARE c1 INSENSITIVE SCROLL CURSOR FOR
   select title_id, royalty
   from authors
   where royalty < 25 END-EXEC.
EXEC SQL OPEN c1 END-EXEC.
```

Usage

- If *cursor sensitivity* is specified as INSENSITIVE, SCROLL is not implied.
- If *cursor sensitivity* is not specified as INSENSITIVE or SEMI_SENSITIVE, and SCROLL is also not specified in the declare cursor, the cursor is scrollable and read-only with the specified sensitivity.
- If *cursor sensitivity* is not specified, the cursor is declared as non-sensitive, non-scrollable and read-only.
- If *cursor scrollability* is specified as SCROLL, the cursor is INSENSITIVE.
- If *cursor scrollability* is not specified, the default is NO SCROLL, and the cursor is declared as non-scrollable and read-only.

See also scroll fetch, open

delete (positioned cursor)

Description Removes, from a table, the row indicated by the current cursor position for an open cursor.

Syntax exec sql [at *connection_name*] delete
[from] *table_name*
where current of *cursor_name* end-exec

Parameters *table_name*
The name of the table from which the row will be deleted.

where current of *cursor_name*

Causes Adaptive Server Enterprise to delete the row of the table indicated by the current cursor position for the cursor *cursor_name.*

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01       PUB-NAME    PIC X(40).
            01       PUB-ID      PIC X(4).
            01       PUB-CTY     PIC X(15).
            01       PUB-ST      PIC X(2).
            01       ANSWER      PIC X(1).
 EXEC SQL END DECLARE SECTION END-EXEC.
      ....
      ....
 EXEC SQL DECLARE delcursor CURSOR FOR
      SELECT * FROM publishers END-EXEC.

 EXEC SQL OPEN delcursor END-EXEC.
 PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
 EXEC SQL CLOSE delcursor END-EXEC.
 EXEC SQL DEALLOCATE CURSOR delcursor END-EXEC.
 EXEC SQL COMMIT WORK END-EXEC.
      ...
 FETCH-LOOP.
      EXEC SQL FETCH delcursor INTO
           :PUB-ID, :PUB-NAME,
           :PUB-CTY, PUB-ST END-EXEC.
      DISPLAY "PUB ID    :", PUB-ID
      DISPLAY "PUB NAME  :", PUB-NAME
      DISPLAY "PUB CITY  :", PUB-CTY
      DISPLAY "PUB STATE :", PUB-ST

      IF SQLCODE = 100
           DISPLAY "NO MORE RECORDS TO FETCH. END OF PROGRAM RUN."
      ELSE
           DISPLAY "DELETE THIS RECORD ?(Y/N) "
           ACCEPT ANSWER
           IF ANSWER = "Y"
           EXEC SQL DELETE publishers WHERE CURRENT OF
                delcursor  END-EXEC
      END-IF.
```

Usage

- This reference page mainly describes aspects of the Transact-SQL delete statement that differ when used with Embedded SQL. See the *Adaptive Server Enterprise Reference Manual.*

- This form of the delete statement must execute on the connection where the cursor *cursor_name* was opened. If the delete statement includes the at*connection_name* clause, the clause must match the at*connection_name*clause of the open cursor statement that opened *cursor_name*.
- The delete statement fails if the cursor was declared for read only, or if the select statement included an order by clause.

See also close, declare cursor, fetch, open, update

delete (searched)

Description Removes rows specified by search conditions.

Syntax exec sql [at *connection_name*] delete *table_name_1*
[from *table_name_n*
[, *table_name_n*]...]
[where *search_conditions*] end-exec

Parameters *table_name_1*
The name of the table from which this delete statement deletes rows.

from *table_name_n*
The name of a table to be joined with *table_name_1* to determine which rows of *table_name_1* will be deleted. The delete statement does *not* delete rows from *table_name_n*.

where *search_conditions*
Specifies which rows will be deleted. If you omit the where clause, the delete statement deletes all rows of *table_name_1*.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     AU-FNAME      PIC X(30).
      01     AU-LNAME      PIC X(30).
      01     AU-ID         PIC X(11).
      01     TITLE-ID      PIC X(6).
 EXEC SQL END DECLARE SECTION END-EXEC.
           ...
 EXEC SQL WHENEVER SQLERROR PERFORM ROLLBACK-PARA.

 EXEC SQL USE pubs2 END-EXEC.
```

```
 DISPLAY "AUTHOR FIRST NAME ? "
 ACCEPT AU-FNAME.
 DISPLAY "AUTHOR LAST NAME ? "
 ACCEPT AU-LNAME.

 EXEC SQL SELECT au_id FROM authors INTO :AU-ID
         WHERE au_fname = :AU-FNAME
              AND au_lname = :AU-LNAME END-EXEC.

 EXEC SQL BEGIN TRANSACTION END-EXEC.

* Delete matching records from the 'au_pix' table.
 EXEC SQL DELETE au_pix WHERE au_id = :AU-ID END-EXEC.

* Delete matching records from the 'blurbs' table.
 EXEC SQL DELETE blurbs WHERE au_id = :AU-ID END-EXEC.

* Delete matching records from the titleauthor table. Since
* we can't have titles associated with this author in other
* related tables, we delete those records too.
 EXEC SQL DECLARE selcursor CURSOR FOR
       SELECT title_id FROM titleauthor
           WHERE au_id = :AU-ID END-EXEC.
 EXEC SQL OPEN selcursor END-EXEC.
 PERFORM FETCH-DEL-LOOP UNTIL SQLCODE = 100.

 EXEC SQL CLOSE selcursor END-EXEC.
 EXEC SQL DEALLOCATE CURSOR selcursor END-EXEC.

* Delete matching records from the 'authors' table.
 EXEC SQL DELETE authors WHERE au_id = :AU-ID END-EXEC.

* Commit all the transactions to the database.
 EXEC SQL COMMIT TRANSACTION END-EXEC.

               ...

 FETCH-DEL-LOOP.
    EXEC SQL FETCH selcursor INTO :TITLE-ID END-EXEC
    IF SQLCODE <> 100
       EXEC SQL DELETE salesdetail WHERE title_id = :TITLE-ID END-EXEC
       EXEC SQL DELETE roysched    WHERE title_id = :TITLE-ID END-EXEC
       EXEC SQL DELETE titles      WHERE title_id = :TITLE-ID END-EXEC
       EXEC SQL DELETE titleauthor WHERE CURRENT OF selcursor END-EXEC
    END-IF.
 END-FETCH-LOOP.
```

```
* Rollback the transacion in case of errors.
 ROLLBACK-PARA.
 DISPLAY "ERROR! ROLLING BACK TRANSACTION!"
    DISPLAY "Error code is " SQLCODE.
    DISPLAY "Error message is " SQLERRMC.

 EXEC SQL ROLLBACK TRANSACTION END-EXEC.
                ...
```

Usage

- This reference page describes mainly aspects of the Transact-SQL delete statement that differ when used with Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- If you need to remove rows specified by the current position of a cursor pointer, use the delete (positioned cursor) statement.

See also close, declare cursor, fetch, open, update

describe input (SQL descriptor)

Description Obtains information about dynamic parameter markers in a prepared dynamic SQL statement and stores that information in a SQL descriptor.

For a list of possible SQL descriptor datatype codes, see Table 9-5 on page 175.

Syntax exec sql describe input *statement_name*
using sql descriptor *descriptor_name* end-exec

Parameters *statement_name*
The name of the prepared statement about which you want information. *statement_name* must identify a prepared statement.

sql descriptor
Identifies *descriptor_name* as a SQL descriptor.

descriptor_name
The name of the SQL descriptor that is to store information about the dynamic parameter markers in the prepared statement.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     QUERY     PIC X(100).
      01     NIN      PIC S9(9) COMP.
```

```
     01     COUNTER PIC S9(9) COMP.
     01     COLTYPE PIC S9(9) COMP.
     01     COLLEN      PIC S9(9) COMP.
EXEC SQL END DECLARE SECTION END-EXEC.
     ...
EXEC SQL ALLOCATE DESCRIPTOR din WITH MAX 256 END-EXEC.

DISPLAY "ENTER QUERY :"
ACCEPT QUERY.

EXEC SQL PREPARE dynstmt FROM :QUERY END-EXEC.
EXEC SQL DESCRIBE INPUT dynstmt USING
          SQL DESCRIPTOR din END-EXEC.

EXEC SQL GET DESCRIPTOR din :NIN = COUNT END-EXEC.
MOVE 1 TO COUNTER.
PERFORM GET-DESC-LOOP UNTIL COUNTER > NIN.
EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
EXEC SQL DEALLOCATE DESCRIPTOR din END-EXEC.
     ...
GET-DESC-LOOP.
     EXEC SQL GET DESCRIPTOR din VALUE
               :COUNTER :COLTYPE = TYPE END-EXEC
     EXEC SQL GET DESCRIPTOR din VALUE
               :COUNTER :COLLEN = LENGTH END-EXEC
     DISPLAY "TYPE OF INPUT = ", COLTYPE
     DISPLAY "INPUT  LENGTH = ", COLLEN
     ADD 1 TO COUNTER .
END-GET-DESC-LOOP.
```

Usage

- Information about the statement is written into the descriptor provided in the using clause. Use the get descriptor statement after executing the describe input statement to extract information from the descriptor into host variables.
- The descriptor must be allocated before the describe input statement can be executed.

See also

allocate descriptor, deallocate descriptor, describe output, get descriptor, prepare, set descriptor

describe input (SQLDA)

Description

Obtains information about dynamic parameter markers in a prepared dynamic SQL statement and stores that information in a SQLDA structure.

Syntax

exec sql describe input *statement_name*
using descriptor *descriptor_name* end-exec

Parameters

statement_name

The name of the prepared statement about which you want information. *statement_name* must identify a prepared statement.

descriptor

Identifies *descriptor_name* as a SQLDA structure.

descriptor_name

The name of the SQLDA structure that is to store information about the dynamic parameter markers in the prepared statement.

Examples

```
...
...
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
    01      QUERY      PIC X(100).
EXEC SQL END DECLARE SECTION END-EXEC.

    01      din.
        05 SD-SQLN PIC S9(4) COMP.
        05 SD-SQLD PIC S9(4) COMP.
        05 SD-COLUMN OCCURS 3 TIMES.
            10 SD-DATAFMT.
                15 SQL--NM PIC X(132).
                15 SQL--NMLEN PIC S9(9) COMP.
                15 SQL--DATATYPE PIC s9(9) COMP.
                15 SQL--FORMAT PIC S9(9) COMP.
                15 SQL--MAXLENGTH PIC S9(9) COMP.
                15 SQL--SCALE PIC S9(9) COMP.
                15 SQL--PRECISION PIC S9(9) COMP.
                15 SQL--STTUS PIC S9(9) COMP.
                15 SQL--COUNT PIC S9(9) COMP.
                15 SQL--USERTYPE PIC S9(9) COMP.
                15 SQL--LOCALE PIC S9(9) COMP.
            10 SD-SQLDATA PIC S9(9) COMP.
            10 SD-SQLIND  PIC S9(9) COMP.
            10 SD-SQLLEN  PIC S9(9) COMP.
            10 SD-SQLMORE PIC S9(9) COMP.
    01 TMP PIC Z(8)9.
```

```
        ...

DISPLAY "ENTER QUERY :"
ACCEPT QUERY.

EXEC SQL ALLOCATE DESCRIPTOR din WITH MAX 256 END-EXEC.
EXEC SQL PREPARE dynstmt FROM :QUERY END-EXEC.
EXEC SQL DECLAR selcursor CURSOR FOR dynstmt END-EXEC.
EXEC SQL DESCRIBE INPUT dynstmt USING DESCRIPTOR din END-EXEC.

* SD-SQLD contains the number of columns in the query being described
    MOVE SD-SQLD TO TMP.
    DISPLAY "Number of input parameters = ", SD-SQLD.

        ...
```

Usage

Information about the statement is written into the descriptor specified in the using clause. After the get descriptor statement is executed, you can read the information out of the SQLDA structure.

See also

allocate descriptor, deallocate descriptor, describe output, get descriptor, prepare, set descriptor

describe output (SQL descriptor)

Description

Obtains row format information about the result set of a prepared dynamic SQL statement.

For a list of possible SQL descriptor datatype codes, see Table 9-5 on page 175.

Syntax

exec sql describe [output] *statement_name*
using sql descriptor *descriptor_name* end-exec

Parameters

output

An optional keyword that has no effect on the describe output statement but provides conformance to the SQL standard.

statement_name

The name (specified in a prepare statement) that represents the select statement to be executed.

sql descriptor

Identifies *descriptor_name* as a SQL descriptor.

descriptor_name
The name of a SQL descriptor that is to store the information returned by the describe output statement.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
          01      QUERY        PIC X(100).
          01      NOUT         PIC S9(9) COMP.
          01      DATAVAL      PIC X(100).
          01      COUNTER      PIC S9(9) COMP.
          01      NUMCOLS      PIC S9(9) COMP.
          01      COLNAME      PIC X(32).
          01      COLTYPE      PIC S9(9) COMP.
          01      COLLEN       PIC S9(9) COMP.
 EXEC SQL END DECLARE SECTION END-EXEC.
           ...
 DISPLAY "ENTER QUERY :"
 ACCEPT QUERY.

 EXEC SQL ALLOCATE DESCRIPTOR desc_out WITH MAX 256 END-EXEC.
 EXEC SQL PREPARE dynstmt FROM :QUERY END-EXEC.
 EXEC SQL DECLARE selcursor CURSOR FOR dynstmt END-EXEC.
 EXEC SQL OPEN selcursor USING SQL DESCRIPTOR desc_out END-EXEC.
 EXEC SQL DESCRIBE OUTPUT dynstmt USING SQL DESCRIPTOR desc_out END-EXEC.

 PERFORM  FETCH-LOOP UNTIL SQLCODE = 100.
 EXEC SQL CLOSE selcursor END-EXEC.
 EXEC SQL DEALLOCATE CURSOR selcursor END-EXEC.
 EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
 EXEC SQL DEALLOCATE DESCRIPTOR desc_out END-EXEC.
           ...
 FETCH-LOOP.
      EXEC SQL FETCH selcursor INTO SQL DESCRIPTOR desc_out END-EXEC
      EXEC SQL GET DESCRIPTOR desc_out :NOUT = COUNT END-EXEC
      DISPLAY "COLS RETRIEVED = ", NOUT
      MOVE 1 TO COUNTER
      PERFORM GET-DESC-PARA UNTIL  COUNTER > NOUT.
  END-FETCH-LOOP.

  GET-DESC-PARA.
       EXEC SQL GET DESCRIPTOR desc_out VALUE :COUNTER
                         :COLNAME = NAME,
                         :COLTYPE = TYPE,
                         :COLLEN  = LENGTH
                       END-EXEC
         DISPLAY "NAME      :", COLNAME
```

```
            DISPLAY "TYPE      :", COLTYPE
            DISPLAY "LENGTH    :", COLLEN

            EXEC SQL GET DESCRIPTOR desc_out VALUE :COUNTER
                                :DATAVAL = DATA END-EXEC
            DISPLAY "DATA      :", DATAVAL
            DISPLAY " "
            ADD 1 TO COUNTER.
      END-GET-DESC-PARA.
```

Usage

- The information obtained is the type, name, length (or precision and scale, if a number), nullable status, and number of items in the result set.
- The information is about the result columns from the select column list.
- Execute this statement before the prepared statement executes. If you perform a describe output statement after you execute and before you perform a get descriptor, the results will be discarded.

See also allocate descriptor, describe input, execute, get descriptor, prepare

describe output (SQLDA)

Description Obtains row format information about the result set of a prepared dynamic SQL statement and stores that information in a SQLDA structure.

Syntax exec sql describe [output] *statement_name*
using descriptor *sqlda_name* end-exec

Parameters

output
An optional keyword that has no effect on the describe output statement but provides conformance to the SQL standard.

statement_name
The name (specified in a prepare statement) that represents the select statement to be executed.

descriptor
Identifies *descriptor_name* as a SQLDA structure.

sqlda_name
The name of a SQLDA structure that is to store the information returned by the describe output statement:

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
       01      QUERY          PIC X(100).
       01      CHARVAR        PIC X(100).
 EXEC SQL END DECLARE SECTION END-EXEC.

 01      dout.
                   05 SD-SQLN      PIC S9(4) COMP.
                   05 SD-SQLD      PIC S9(4) COMP.
                   05 SD-COLUMN OCCURS 3 TIMES.
                   10 SD-DATAFMT.
                      15 SQL--NM        PIC X(132).
                      15 SQL--NMLEN     PIC S9(9) COMP.
                      15 SQL--DATATYPE  PIC s9(9) COMP.
                      15 SQL--FORMAT     PIC S9(9) COMP.
                      15 SQL--MAXLENGTH  PIC S9(9) COMP.
                      15 SQL--SCALE      PIC S9(9) COMP.
                      15 SQL--PRECISION  PIC S9(9) COMP.
                      15 SQL--STTUS      PIC S9(9) COMP.
                      15 SQL--COUNT      PIC S9(9) COMP.
                      15 SQL--USERTYPE   PIC S9(9) COMP.
                      15 SQL--LOCALE     PIC S9(9) COMP.

                   10 SD-SQLDATA    PIC S9(9) COMP.
                   10 SD-SQLIND     PIC S9(9) COMP.
                   10 SD-SQLLEN     PIC S9(9) COMP.
                   10 SD-SQLMORE    PIC S9(9) COMP.
   01      TMP                PIC Z(8)9.
   01      COLNUM             PIC S9(9) COMP.
   01      TMP1               PIC S9(9) COMP.
   01      TMP2               PIC S9(9) COMP.
   01      RETCODE            PIC S9(9) COMP.
        ...

 DISPLAY "ENTER QUERY :"
 ACCEPT QUERY.

 EXEC SQL ALLOCATE DESCRIPTOR dout WITH MAX 256 END-EXEC.
 EXEC SQL PREPARE dynstmt FROM :QUERY END-EXEC.
 EXEC SQL DECLARE selcursor CURSOR FOR dynstmt END-EXEC.
 EXEC SQL OPEN selcursor END-EXEC.
 EXEC SQL DESCRIBE OUTPUT dynstmt
              USING DESCRIPTOR dout END-EXEC.

 MOVE 1  TO COLNUM.
 MOVE 25 TO TMP1.
```

```
MOVE 0  TO TMP2.

CALL "SYBSETSQLDA" USING RETCODE dout COLNUM
      CHARVAR SYB-X-PIC TMP1 TMP2 SYB-NO-USAGE
            SYB-NO-SIGN.

EXEC SQL FETCH selcursor INTO DESCRIPTOR dout END-EXEC.
DISPLAY "CHARVAR = ", CHARVAR.

EXEC SQL CLOSE selcursor END-EXEC.
EXEC SQL DEALLOCATE CURSOR selcursor END-EXEC.
EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
EXEC SQL DEALLOCATE DESCRIPTOR dout END-EXEC.
```

Usage

- The information obtained is data held in the SQLDA fields, such as the type, name, length (or precision and scale, if a number), nullable status, and number of items in the result set.
- The information is about the result columns from the select column list.

See also describe input, execute, prepare

disconnect

Description Closes one or more connections to a Adaptive Server Enterprise.

Syntax exec sql disconnect
{*connection_name* | current | DEFAULT| all} end-exec

Parameters

connection_name
The name of a connection to be closed.

current
Specifies that the current connection is to be closed.

DEFAULT
Specifies that the default connection is to be closed. This keyword must be in uppercase letters if you specify the default *connection_name* using a character string variable, for example:

```
exec sql disconnect :hv;
```

all
Specifies that all active connections be closed.

Examples

```
 EXEC SQL BEGIN DECLARE SECTION END-EXEC.
       01     SERV-NAME    PIC X(25).
       01     USER-NAME    PIC X(25).
       01     PASSWORD     PIC X(25).
       01     CONN-NAME    PIC X(25).
  EXEC SQL END DECLARE SECTION END-EXEC.
            ...
  MOVE "sa" TO USER-NAME.
  MOVE ""   TO PASSWORD.

* Make a default connection.
  EXEC SQL CONNECT :USER-NAME IDENTIFIED BY :PASSWORD END-EXEC.
  EXEC SQL SELECT @@servername into :srvname END-EXEC.
  DISPLAY "NOW CONNECTED TO SERVER ", srvname.

* Accept a server name from the user and make a new connection.
  DISPLAY "SERVER NAME? ".
  ACCEPT SERV-NAME.
  EXEC SQL CONNECT :USER-NAME IDENTIFIED BY :PASSWORD
                   At conn2 USING :SERV-NAME END-EXEC.

  EXEC SQL SELECT @@servername into :srvname END-EXEC
  DISPLAY "NOW CONNECTED TO SERVER ", srvname.

* Make a third connection.
  EXEC SQL CONNECT :USER-NAME IDENTIFIED BY :PASSWORD
                   At conn3 USING :SERV-NAME END-EXEC.

  EXEC SQL SELECT @@servername into :srvname END-EXEC.
  DISPLAY "NOW CONNECTED TO SERVER ", srvname.

* Now set the current connection to DEFAULT.
  EXEC SQL SET CONNECTION DEFAULT END-EXEC.

* Now disconnect the first connection which is the default.
  DISPLAY "DISCONNECTING DEFAULT!".
  EXEC SQL DISCONNECT DEFAULT END-EXEC.

* Now sdet the current connection to connection2.
  EXEC SQL SET CONNECTION conn2 END-EXEC.

* Now disconnect the third connection.
  DISPLAY "DISCONNECTING THIRD!".
  EXEC SQL DISCONNECT conn3 END-EXEC.
```

```
* Disconnect remaining connections - case 'conn2' will be closed.
  DISPLAY "DISCONNECTING ALL!".
  EXEC SQL DISCONNECT ALL END-EXEC.
```

Usage

- By itself, the disconnect keyword is not a valid statement. Instead, it must be followed by *connection_name*, current, DEFAULT, or all.
- Closing a connection releases all memory and resources associated with that connection.
- disconnect does not commit current transactions; it rolls them back. If an unchained transaction is active on the connection, disconnect rolls it back, ignoring any savepoints.
- Closing a connection closes open cursors, drops temporary Adaptive Server Enterprise objects, releases any locks the connection has in the Adaptive Server Enterprise, and closes the network connection to the Adaptive Server Enterprise.

See also

commit work, commit transaction, connect, rollback transaction, rollback work

exec

Description

Runs a system procedure or a user-defined stored procedure.

Syntax

exec sql [at *connection_name*]
exec [:*status_var* = *status_value*] *procedure_name*
[([[@*parameter_name* =]*param_value* [out[put]]],...)]
[into :*hostvar_1* [:*indicator_1*]
[, *hostvar_n* [*indicator_n*,...]]]
[with recompile] end-exec

Note Do not confuse the exec statement with the Embedded SQL execute statement; they are not related. The Embedded SQL exec statement is, however, the equivalent of the Transact-SQL execute statement.

Parameters

status_var
A host variable to receive the return status of the stored procedure.

status_value
The value of the stored procedure return status variable *status_var*.

procedure_name
The name of the stored procedure to be executed.

parameter_name
The name(s) of the stored procedure's parameter(s).

param_value
A host variable or literal value.

output
Indicates that the stored procedure returns a parameter value. The matching parameter in the stored procedure must also have been created using the output keyword.

into *:hostvar_1*
Causes row data returned from the stored procedure to be stored in the specified host variables (*hostvar_1* through *hostvar_n*). Each host variable can have an indicator variable.

with recompile
Causes Adaptive Server Enterprise to create a new query plan for this stored procedure each time the procedure executes.

Examples

Example 1

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     TITLE-ID   PIC X(6).
      01     TOTAL-DISC PIC S9(9).
      01     RET-STATUS PIC S9(9).
 EXEC SQL END DECLARE SECTION END-EXEC.
      ...
 EXEC SQL CREATE PROC get_sum_discounts(@title_id tid,
           @discount int output) as
           begin
                select @discount = sum (qty*discount)
                     from salesdetail
                     where title_id = @title_id
           end
 END-EXEC.

 EXEC SQL SET CHAINED ON END-EXEC.
 DISPLAY "TITLE ID ? ".
 ACCEPT TITLE-ID.

 EXEC SQL EXEC :RET-STATUS = get_sum_discounts
            :TITLE-ID, :TOTAL-DISC OUT END-EXEC.

 DISPLAY "TOTAL DISCOUNTS FOR TITLE ID ", TITLE-ID," = ",TOTAL-DISC.

      ...
```

Example 2

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     PUB-ID         PIC X(4).
      01     NAME       PIC X(25).
      01     CITY       PIC X(25).
      01     STATE      PIC X(2).
      01     RET-STATUS PIC S9(9).
 EXEC SQL END DECLARE SECTION END-EXEC.
      ...
 EXEC SQL CREATE PROC get_publishers(@pubid char(4))
       as
           select pub_name, city, state from
             publishers where pub_id = @pubid
      END-EXEC.

 DISPLAY " DETAIL RECORD FOR PUBLISHER ? ".
 ACCEPT PUB-ID.

 EXEC SQL EXEC :RET-STATUS = get_publishers :PUB-ID
                INTO :NAME, :CITY, :STATE END-EXEC.

 IF RET-STATUS = 0
      DISPLAY " PUBLISHER NAME : ", NAME
      DISPLAY " CITY           : ", CITY
      DISPLAY " STATE           : ", STATE
```

Usage

- Only one select statement can return rows to the client application.
- If the stored procedure contains select statements that can return row data, you must use one of two methods to store the data. You can either use the into clause of the exec statement or declare a cursor for the procedure. If you use the into clause, the stored procedure must not return more than one row of data, unless the host variables that you specify are arrays.
- The value *param_value* can be a host variable or literal value. If you use the output keyword, *param_value* must be a host variable.
- You can specify the output keyword for *parameter_name* only if that keyword was also used for the corresponding parameter of the create procedure statement that created *procedure_name*.
- The Embedded SQL exec statement works much like the Transact-SQL execute statement.

See also

declare cursor (stored procedure), select

exec sql

Description

Marks the beginning of a SQL statement embedded in a host language program.

Syntax

exec sql [at *connection_name*] *sql_statement* end-exec

Parameters

at

Causes the SQL statement *sql_statement*to execute at the Adaptive Server connection *connection_name*.

connection_name

The connection name that identifies the Adaptive Server connection where *sql_statement* is to execute. The *connection_name* must be defined as a previous connect statement.

sql_statement

A Transact-SQL statement or other Embedded SQL statement.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     SITE1     PIC X(25).
           01     SALES1     PIC S9(9) COMP.
      EXEC SQL END DECLARE SECTION END-EXEC.

      EXEC SQL CONNECT "user" identified by "password"
           AT server1 USING "server1" END-EXEC.
      EXEC SQL CONNECT "user" identified by "password"
           AT server2 USING "server2" END-EXEC.


      EXEC SQL AT server1 USE pubs2 END-EXEC.
      EXEC SQL AT server2 USE pubmast END-EXEC.

      EXEC SQL AT server1 SELECT count(*) FROM sales
                INTO :sales1 END-EXEC.

      MOVE "server1" TO SITE1.

      EXEC SQL SET CONNECTION server2 END-EXEC.
      EXEC SQL INSERT numsales VALUES (:SITE1, :SALES1) END-EXEC.
      EXEC SQL COMMIT WORK END-EXEC.
           ...
```

Usage

- SQL statements embedded in a host language must begin with “exec sql”. The keywords exec sql can appear anywhere that a host language statement can begin.

- The statement *sql_statement* can occupy one or more program lines; however, it must conform to host language rules for line breaks and continuation lines.
- The at clause affects only the statement *sql_statement*. The clause does not affect subsequent SQL statements, and does not reset the current connection.
- The at clause is not valid when *sql_statement* is one of the following SQL statements:

Table 9-2: Statements that cannot use the at clause of exec sql

allocate descriptor	begin declare section	connect
deallocate descriptor	declare cursor (dynamic)	end declare section
exit	get diagnostics	include file
include sqlca	set connection	set diagnostics
whenever		

- *connection_name* must be defined in a previous connect statement.
- Each Embedded SQL statement must end with a terminator. In COBOL, the terminator is the keyword end-exec.

See also: begin declare section, connect, disconnect, set connection

execute

Description

Executes a dynamic SQL statement from a prepared statement.

See execute immediate on page 145.

Syntax

```
exec sql [at connection_name] execute statement_name
 [into {host_var_list |
    descriptor descriptor_name |
    sql descriptor descriptor_name}]
 [using {host_var_list |
    descriptor descriptor_name |
    sql descriptor descriptor_name}] end-exec
```

Note Do not confuse the Embedded SQL execute statement with the Embedded SQL exec statement or the Transact-SQL execute statement.

Parameters

statement_name
A unique identifier for the statement, defined in a previous prepare statement.

descriptor_name
Specifies the area of memory, or the SQLDA structure, that describes the statement's dynamic parameter markers or select column list.

into
An into clause is required when the statement executes a select statement, which must be a single-row select. The target of the into clause can be a SQL descriptor, a SQLDA structure, or a list of one or more Embedded SQL host variables.

Each host variable in the *host_var_list* must first be defined in a declare section. An *indicator variable* can be associated with a host variable to show when a null data value is retrieved.

descriptor
Identifies *descriptor_name* as a SQLDA structure.

sql descriptor
Identifies *descriptor_name* as a SQL descriptor.

using
The host variables that are substituted for dynamic parameter markers in *host_var_list*. The host variables, which you must define in a declare section, are substituted in the order listed. Use this clause only when *statement_name* contains dynamic parameter markers. The dynamic descriptor can also contain the values for the dynamic parameter markers.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
        01     DEMO-BUF   PIC X(100).
        01     TITLE-ID   PIC X(6).
        01     ORDER-NO   PIC X(20).
        01     QTY        PIC S9(9).
   EXEC SQL END DECLARE SECTION END-EXEC.
            ...
   MOVE "INSERT salesdetail(ord_num, title_id, qty) VALUES( :?, :?, :?)"
 -                 TO DEMO-BUF.
   EXEC SQL PREPARE ins_stmt FROM :DEMO-BUF END-EXEC.

   DISPLAY "RECORDING BOOK SALES".
   DISPLAY "ORDER # ? ".
   ACCEPT ORDER-NO.
   DISPLAY "TITLE ID? ".
```

```
ACCEPT TITLE-ID.
DISPLAY "QTY SOLD? ".
ACCEPT QTY.

EXEC SQL EXECUTE ins_stmt USING :ORDER-NO, :TITLE-ID, :QTY END-EXEC.
        ...
```

Usage

- execute is the second step in method 2 of dynamic SQL. The first step is the prepare statement.
- prepare and execute are valid with any SQL statement except a multirow select statement. For multirow select statements, use either dynamic cursor.
- The statement in *statement_name* can contain dynamic parameter markers (“?”). They mark the positions where host variable values are to be substituted before the statement executes.
- The execute keyword distinguishes this statement from exec. See the exec on page 139 reference page for information on exec.

See also declare section, get descriptor, prepare, set descriptor

execute immediate

Description Executes a dynamic SQL statement stored in a character-string host variable or quoted string.

Syntax exec sql [at *connection_name*] execute immediate
{:*host_variable* | “string”} end-exec

Parameters

host_variable
A character-string host variable defined in a declare section. Before calling execute immediate, the host variable should contain a complete and syntactically correct Transact-SQL statement.

string
A quoted literal Transact-SQL statement string that can be used in place of *host_variable*.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     HOST-VAR    PIC X(100).
     EXEC SQL END DECLARE SECTION END-EXEC.
           ...
     DISPLAY "ENTER A NON-SELECT SQL STATEMENT: ".
     ACCEPT HOST-VAR.
```

```
EXEC SQL EXECUTE IMMEDIATE :HOST-VAR END-EXEC.
     ...
```

Usage

- Using the execute immediate statement is dynamic SQL method 1. See Chapter 7, “Using Dynamic SQL,” for information about the four dynamic SQL methods.
- Except for messages, the statement in *host_variable* cannot return results to the your program. Thus, the statement cannot be, for example, a select statement.
- The Embedded SQL precompiler does not check the syntax of the statement stored in *host_variable* before sending it to Adaptive Server Enterprise. If the statement’s syntax is incorrect, Adaptive Server Enterprise returns an error code and message to your program.
- Use prepare and execute (dynamic SQL method 2) to substitute values from host variables into a dynamic SQL statement.
- Use prepare, open, and fetch (dynamic SQL method 3) to execute select statements with dynamic SQL statements that return results.

See also execute, prepare

exit

Description Closes Client-Library and deallocates all Embedded SQL resources allocated to your program.

Syntax exec sql exit end-exec

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
          01     HOST-VAR    PIC X(100).
     EXEC SQL END DECLARE SECTION END-EXEC.
          ...
     EXEC SQL SELECT getdate() INTO :HOST-VAR END-EXEC.

     DISPLAY "THE CURRENT DATE AND TIME IS: ", HOST-VAR.

* Note that the exit statement must be the last embedded SQL statement
* in the program.

     EXEC SQL EXIT END-EXEC.
```

Usage

- The exit statement closes all connections that your program opened. Also, exit deallocates all Embedded SQL resources and Client-Library resources allocated to your program.
- Although the exit statement is valid on all platforms, it is required only on some. See the *Open Client and Open Server Programmers Supplement*.
- You cannot use Client-Library functions after using the exit statement, unless you initialize Client-Library again. See the *Open Client Client-Library/C Programmers Guide* for information about initializing Client-Library.
- The exit statement is a Sybase extension; it is not defined in the SQL standard.

See also

disconnect

fetch

Description

Copies data values from the current cursor row into host variables or a dynamic descriptor.

Syntax

```
exec sql [at connection_name] fetch [rebind | norebind] cursor_name
into {:host_variable [[indicator]:indicator_variable]
 [,:host_variable
 [[indicator]:indicator_variable]]… |
 descriptor descriptor_name |
 sql descriptor descriptor_name} end-exec
```

Parameters

rebind | norebind

Specifies whether host variables require rebinding for this fetch statement. The rebind clause overrides precompiler options that control rebinding.

cursor_name

The name of the cursor. The name is defined in a preceding declare cursor statement.

host_variable

A host language variable defined in a declare section.

indicator_variable

A 2-byte host variable declared in a previous declare section. If the value for the associated variable is null, fetch sets the indicator variable to -1. If truncation occurs, fetch sets the indicator variable to the actual length of the result column. Otherwise, it sets the indicator variable to *0*.

descriptor
Identifies *descriptor_name* as a SQLDA structure.

sql descriptor
Identifies *descriptor_name* as a SQL descriptor.

descriptor_name
The name of the dynamic descriptor that is to hold a result set.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     TITLE-ID   PIC X(6).
      01     BOOK-NAME  PIC X(80).
      01     BOOK-TYPE  PIC X(12).
      01     I-TITLE    PIC S9(9).
      01     I-TYPE     PIC S9(9).
 EXEC SQL END DECLARE SECTION END-EXEC.
      ...
 EXEC SQL DECLARE title_list CURSOR FOR
      SELECT type, title_id, title FROM titles
      ORDER BY type END-EXEC.

 EXEC SQL OPEN title_list END-EXEC.
 PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
 EXEC SQL CLOSE title_list END-EXEC.
      ...
 FETCH-LOOP.
      EXEC SQL FETCH title_list INTO
                :BOOK-TYPE :I-TYPE,
                :TITLE-ID,
                :BOOK-NAME :I-TITLE END-EXEC
 * Check the indicator value - if not null display the value, else
 * display UNDECIDED.
      IF I-TYPE <> -1
           DISPLAY "TYPE : ", BOOK-TYPE
      ELSE
           DISPLAY "TYPE : UNDECIDED"
      END-IF

      DISPLAY "TITLE ID : ", TITLE-ID

      IF I-TITLE <> -1
           DISPLAY "TITLE : ", BOOK-NAME
      ELSE
           DISPLAY "TITLE : UNDECIDED"
      END-IF.
 END-FETCH-LOOP.
```

Usage

- The fetch statement can be used both with static cursors and with cursors in dynamic SQL.
- The open statement must execute before the fetch statement executes.
- The first fetch on an open cursor returns the first row or group of rows from the cursor's result table. Each subsequent fetch returns the next row or group of rows.
- You can fetch multiple rows into an array.
- The "current row" is the row most recently fetched. To update or delete it, use the where current of *cursor_name* clause with the update or delete statement. These statements are not valid until after a row has been fetched.
- After all rows have been fetched from the cursor, calling fetch sets SQLCODE to *100*. If the select statement furnishes no results on execution, SQLCODE is set to 100 on the first fetch.
- There must be one, and only one, *host_variable* for each column of the result set.
- When neither the rebind nor the norebind option is specified, the binding behavior is determined by the precompiler option -b. See the *Open Client and Open Server Programmers Supplement* for details on precompiler options.
- An *indicator_variable* must be provided for a *host_variable* that can receive a null value. A runtime error occurs when a null value is fetched for a host variable that has no indicator variable.
- When possible, Client-Library converts the datatype of a result column to the datatype of the corresponding host variable. If Client-Library cannot convert a datatype, it issues an error message. If conversion is not possible, an error occurs.

See also

allocate descriptor, close, declare, delete (positioned cursor), open, prepare, update

scroll fetch

Description

Fetches single or multiple rows from the cursor result set, depending on the ROW_COUNT specification at CURSOR OPEN time.

If a cursor is specified as scrollable, the *fetch orientation* in the FETCH statement specifies the fetch direction.

If the cursor is not specified as scrollable, FETCH retrieves the next row in the result set.

Syntax

```
EXEC SQL FETCH [ <fetch orientation> ]
                        [ FROM ] <cursor name>
                        { [ INTO <fetch target list> ] |
                        [SQL DESCRIPTOR <>]
<fetch orientation> : : =
                        | NEXT
                        | PRIOR
                        | FIRST
                        | LAST
                        | ABSOLUTE <fetch_offset>
                        | RELATIVE <fetch_offset>

<fetch offset> : : =
                        <signed_numeric_literal>
<fetch target list> : : =
                        <target specification>
                        [ { <comma> <target specification> } ]
END-EXEC
```

Parameters

fetch orientation
Specified as NEXT, PRIOR, FIRST, LAST, ABSOLUTE, or RELATIVE.

fetch offset
Specified as an exact, signed numeric value with a scale of zero.

Examples

To fetch a row when a cursor is declared and open:

```
EXEC SQL FETCH LAST FROM c1 INTO :title,:roy END-EXEC.
```

To fetch a previous row:

```
EXEC SQL FETCH PRIOR FROM c1 INTO :title,:roy END-EXEC.
```

To fetch row 20:

```
EXEC SQL FETCH ABSOLUTE 20 FROM c1 INTO :title, :roy
          END-EXEC.
```

Usage

If *fetch orientation* is not specified, NEXT is the default.

Note If you specify *fetch orientation* as any type except NEXT on a non-scrollable cursor, you receive the following message:

```
The fetch type can only be used with scrollable cursors.
```

If *fetch orientation* positions the cursor beyond the last row or before the first row, *sqlca.sqlcode* is set to 100, indicating that no rows are found. If an error handler is installed, it may provide additional information.

See also declare, open

get descriptor

Description Retrieves attribute information about dynamic parameter markers and select column list attributes and data from a SQL descriptor.

For a list of SQL descriptor datatype codes, see Table 9-5 on page 175.

Syntax

exec sql get descriptor *descriptor_name*
{:*host_variable* = *count* |
value *item_number* :*host_variable* = *item_name*
[, :*host_variable* = *item_name*]...} end-exec

Parameters

descriptor_name
The name of the SQL descriptor that contains information about the dynamic parameter markers or return columns in a prepared statement.

host_variable
A variable defined in a declare section.

count
The number of dynamic parameters retrieved.

item_number
A number specifying the *n*th dynamic parameter marker or select column, for which get descriptor is to retrieve information.

item_name
The name of an attribute to be retrieved. See Table 9-3 for details.

Table 9-3: Valid item_name values

Value	Description
data	Value for the dynamic parameter marker or target associated with the specified SQL descriptor. If indicator is negative, this field is undefined.
indicator	Value for the indicator parameter associated with the dynamic parameter marker or target.
length	The length, in characters, of the dynamic parameter marker of target for the specified SQL descriptor.
name	The name of the specified SQL descriptor containing information about the dynamic parameter markers.
nullable	Equals *0* if the dynamic parameter marker can accept a null value; otherwise, equals 1.
precision	An integer specifying the total number of digits of precision for the CS_NUMERIC variable.
returned_length	The length of character types of the values from the select column list.
scale	An integer specifying the total number of digits after the decimal point for the CS_NUMERIC variable.
type	The datatype of this column (item number) in the row. For values, see Table 9-5 on page 175.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     QUERY          PIC X(100).
      01     CHARBUF        PIC X(100).
      01     NUMCOLS        PIC S9(9) COMP.
      01     COLNUM         PIC S9(9) COMP.
      01     COLTYPE        PIC S9(9) COMP.
      01     INTBUF         PIC S9(9).
 EXEC SQL END DECLARE SECTION END-EXEC.
      ...
 DISPLAY "ENTER A SELECT STATEMENT :"
 ACCEPT QUERY.
 EXEC SQL ALLOCATE DESCRIPTOR big_desc WITH MAX 256 END-EXEC.
 EXEC SQL PREPARE  dynstmt FROM :QUERY END-EXEC.
 EXEC SQL EXECUTE dynstmt INTO SQL DESCRIPTOR big_desc END-EXEC.
 EXEC SQL GET DESCRIPTOR big_desc :NUMCOLS = COUNT END-EXEC.

 MOVE 1 TO COLNUM.
```

```
        PERFORM GET-DESC-LOOP UNTIL COLNUM > NUMCOLS.
        EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
        EXEC SQL DEALLOCATE DESCRIPTOR big_desc END-EXEC.
             ...
        GET-DESC-LOOP.
             EXEC SQL GET DESCRIPTOR big_desc
                       VALUE :COLNUM
                       :COLTYPE = TYPE END-EXEC
    * Check the type data returned and store in appropriate host variables.
             IF COLTYPE = 4
                  DISPLAY "INTEGER DATA! "
                  EXEC SQL GET DESCRIPTOR big_desc
                       VALUE :COLNUM :INTBUF = DATA END-EXEC
             ELSE
                  IF COLTYPE = 1
                          DISPLAY "CHARACTER DATA! "
                       EXEC SQL GET DESCRIPTOR big_desc
                       VALUE :COLNUM :CHARBUF = DATA END-EXEC

     * Handle other data types accordingly or store them all as characters.
                  ...
             ADD 1 TO COLUMN.
        END-GET-DESC-LOOP.
```

Usage

- The get descriptor statement returns information about the number or attributes of dynamic parameters specified or the select list columns in a prepared statement.
- This statement should be executed after a describe input, describe output, execute, or fetch (dynamic) statement has been issued.
- It is not possible to retrieve *data*, *indicator*, or *returned_length* until the data associated with the descriptor is retrieved from the server by an execute statement or fetch statement.

See also describe input, describe output, fetch, set descriptor

get diagnostics

Description Retrieves error, warning, and informational messages from Client-Library.

Syntax

```
get diagnostics
 {:hv = statement_info [, :hv = statement_info]...|
 exception :condition_number
```

:hv = condition_info [, *:hv = condition_info*]...}
end-exec

Parameters

statement_info
The keyword number is currently the only supported *statement_info* type. It returns the total number of exceptions in the diagnostics queue.

condition_info
Any one of the keywords sqlca_info, sqlcode_number, and returned_sqlstate.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
          01     NUM-MSGS      PIC S9(9) COMP.
          01     CONDCNT       PIC S9(9) COMP.
     EXEC SQL END DECLARE SECTION END-EXEC.
          ...
     EXEC SQL GET DIAGNOSTICS :NUM-MSGS = NUMBER   END-EXEC.
     MOVE 1 TO CONDCNT.
     PERFORM GET-DIAG-PARA UNTIL CONDCNT > NUM-MSGS.
          ...
     GET-DIAG-PARA.
          EXEC SQL GET DIAGNOSTICS EXCEPTION
                :CONDCNT :SQLCA = SQLCA_INFO END-EXEC
          DISPLAY "DIAG. SQLCODE     = ",SQLCODE
          DISPLAY "DIAG. MESSAGE     = ",SQLERRMC

          ADD 1 TO CONDCNT.
     END-GET-DIAG-PARA.
```

Usage

- Many Embedded SQL statements are capable of causing multiple warnings or errors. Typically, only the first error is reported using SQLCODE, SQLCA, or SQLSTATE. Use get diagnostics to process all the errors.
- You can use get diagnostics, which is the target of the call, perform, or go to clause of a whenever statement, in the code.
- You can use get diagnostics after a statement for which you want to retrieve informational messages.

See also

whenever

include “filename”

Description

Includes an external file in an Embedded SQL source file.

Syntax

exec sql include "filename" end-exec

Parameters

"filename"

The name of the file to be included in the Embedded SQL source file containing this statement.

Note The maximum supported length for the COPY statement is 70 characters, including the file and pathname.

Examples

Example 1: using COPY

```
COPY "generic".
     ...
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
     01     SRV-NAME   PIC X(80).
     01     UID        PIC X(32).
     01     PASS       PIC X(32).
EXEC SQL END DECLARE SECTION END-EXEC.
     ...
MOVE USER-NAME TO UID.
MOVE PASSWORD  TO PASS.

EXEC SQL CONNECT :UID IDENTIFIED BY :PASS END-EXEC.

EXEC SQL SELECT @@servername INTO :SRV-NAME END-EXEC.

DISPLAY "CONNECTED TO SERVER ",SRV-NAME.
```

Copy-file code:

```
01      USER-NAME     PIC X(33)     VALUE IS "sa".
 01      PASSWORD      PIC X(33)     VALUE IS "syb123".
```

Example 2: using INCLUDE

```
EXEC SQL INCLUDE "./generic" END-EXEC.

EXEC SQL BEGIN DECLARE SECTION END-EXEC.
     01     SRV-NAME   PIC X(80).
EXEC SQL END DECLARE SECTION END-EXEC.

EXEC SQL CONNECT :USER-NAME IDENTIFIED BY :PASSWORD END-EXEC.

EXEC SQL SELECT @@servername INTO :SRV-NAME END-EXEC.
```

```
        DISPLAY "CONNECTED TO SERVER ",SRV-NAME.
```

Copy-file code:

```
01      USER-NAME     PIC X(33)     VALUE IS "sa".
        01      PASSWORD      PIC X(33)     VALUE IS "syb123".
```

Usage

- The Embedded SQL precompiler processes the included file as though it were part of the Embedded SQL source file, recognizing all declare sections and SQL statements. The Embedded SQL precompiler writes the resulting host language source code into the generated file.
- Use the include path precompiler command line option to specify the directories to be searched for any included files. Refer to the *Open Client and Open Server Programmers Supplement*.
- Included files can be nested up to a maximum depth of 32 files.
- The include "*filename*" statement can be used anywhere.

See also declare section

include sqlca

Description Defines the SQL Communications Area (SQLCA) in an Embedded SQL program.

Syntax exec sql include sqlca end-exec

Examples

```
EXEC SQL INCLUDE SQLCA END-EXEC.
          ...
    EXEC SQL UPDATE test SET col1 = col1 + 100 END-EXEC.
    IF SQLCODE = 0
        DISPLAY "UPDATED ",SQLERRD(3), " ROWS."
    ELSE
        IF SQLCODE = 100
            DISPLAY "NO ROWS WERE AFFECTED."
        ELSE
            DISPLAY "AN ERROR OCCURED - ",SQLERRMC.
        END-IF
    END-IF.
    EXEC SQL COMMIT WORK END-EXEC.
```

Usage — The include sqlca statement can be used anywhere that host language declarations are allowed.

See also — begin declare section

include sqlda

Description — Defines the SQLDA structure in an Embedded SQL program.

Syntax — exec sql include sqlda;

Usage — The include sqlda statement can be used anywhere that host language declarations are allowed.

initialize_application

Description — Generates a call to set the application name on the global CS_CONTEXT handle. If precompiled with the -x option, it will also set the cs_config(CS_SET, CS_EXTERNAL_CONFIG, CS_TRUE) property.

Syntax — exec sql initialize_application
[application_name "=" *application_name*] end-exec

Examples

```
EXEC SQL INCLUDE SQLCA END-EXEC.

   EXEC SQL BEGIN DECLARE SECTION END-EXEC.
          01 SPID          PIC S9(9) COMP.
          01 PROG-NAME     PIC X(33).
          01 UID          PIC X(33).
          01 PASS          PIC X(33).
   EXEC SQL END DECLARE SECTION END-EXEC.

   PROCEDURE DIVISION.
   PO.

* The INITIALIZE_APPLICATION MUST be the FIRST embedded SQL statement
* in the program.

 EXEC SQL INITIALIZE_APPLICATION APPLICATION_NAME
             = "TEST" END-EXEC.
```

```
* The body of the main procedure division goes here including all ESQL
* statements.
   ...EXEC SQL CONNECT :UID IDENTIFIED BY :PASS END-EXEC.
      EXEC SQL SELECT @@spid INTO :SPID END-EXEC.
      EXEC SQL SELECT program_name INTO :PROG-NAME
         FROM master..sysprocesses
         WHERE spid = :SPID END-EXEC.
      DISPLAY "THIS APPLICATION'S NAME IN SYSPROCESSES IS ", PROG-NAME.

    ...EXEC SQL EXIT END-EXEC.
```

Usage

- *application_name* is either a string literal or a character variable containing the name of the application.
- If initialize_application is the *first* Embedded SQL statement executed by an application, -x causes ct_init to use external configuration options to initialize the Client-Library part of the CS_CONTEXT structure.
- If initialize_application is not the first Embedded SQL statement, ct_init does *not* pick up external configuration options.
- Regardless of whether or not initialize_application is the first Embedded SQL statement, -x causes exec sql connect statements to use external configuration data. If -e is also specified, Sybase uses the server name as a key to the configuration data. If -e is not specified, then the application name (or DEFAULT) is used as the key to the configuration data.
- If you specify -x and the application name, the following applies:
  - ct_init uses the application name to determine which section of the external configuration file to use for initialization.
  - The application name is passed to Adaptive Server Enterprise as part of the connect statement. The application name is entered in the sysprocesses.program_name table.
- If -e is specified without -x, then ct_init uses external configuration data when initializing, but every connection will use the server name as a key to the external configuration data. See the *Open Client and Open Server Programmers Supplement* for information on command-line options.

See also

exit

open (dynamic cursor)

Description

Opens a previously declared dynamic cursor.

Syntax

exec sql [at *connection_name*] open *cursor_name*
[row_count = *size*] [using {*host_var_list* |
descriptor *descriptor_name* |
sql descriptor *descriptor_name*}] end-exec

Parameters

cursor_name
Names a cursor that has been declared using the declare cursor statement.

size
The number of rows moved in a network roundtrip, not the number fetched into the host variable. The *size* argument can be either a literal or a declared host variable.

host_var_list
Names the host variables that contain the values for dynamic parameter markers.

descriptor
Identifies *descriptor_name* as a SQLDA structure.

sql descriptor
Identifies *descriptor_name* as a SQL descriptor.

descriptor_name
Names the dynamic descriptor that contains information about the dynamic parameter markers in a prepared statement.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
            01     DYNABUF     PIC X(200).
            01     TITLE-ID    PIC X(6).
            01     LNAME       PIC X(15).
            01     FNAME       PIC X(15).
            01     PHONE       PIC X(15).
       EXEC SQL END DECLARE SECTION END-EXEC.
            ...
       MOVE "SELECT a.au_lname, a.au_fname, a.phone
                 FROM authors a, titleauthor t
                 WHERE a.au_id = t.au_id
                 AND   t.title_id = ? " TO DYNABUF.

       EXEC SQL PREPARE dynastmt FROM :DYNABUF END-EXEC.
       EXEC SQL DECLARE who_wrote CURSOR FOR dynastmt END-EXEC.
```

```
          DISPLAY "LIST AUTHORS FOR WHAT TITLE ? "
          ACCEPT TITLE-ID.

          EXEC SQL OPEN who_wrote USING :TITLE-ID END-EXEC.
          PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
          EXEC SQL CLOSE who_wrote END-EXEC.
          EXEC SQL DEALLOCATE CURSOR who_wrote END-EXEC.
          EXEC SQL DEALLOCATE dynastmt END-EXEC.
               ...
          FETCH-LOOP.
     EXEC SQL FETCH who_wrote INTO
                    :LNAME, :FNAME, :PHONE END-EXEC
               DISPLAY "LAST  NAME : ", LNAME
               DISPLAY "FIRST NAME : ", FNAME
               DISPLAY "PHONE          : ", PHONE.
          END-FETCH-LOOP.
```

Usage

- open executes the statement specified in the corresponding declare cursor statement. You can then use the fetch statement to retrieve the results of the prepared statement.
- You can have any number of open cursors.
- The using clause substitutes host-variable or dynamic-descriptor contents for the dynamic parameter markers (“?”) in the select statement.

See also close, declare, fetch, prepare

open (static cursor)

Description Opens a previously declared static cursor. This statement can be used to open any static cursor, including one for a stored procedure.

Syntax exec sql [at *connection_name*] open *cursor_name*
[row_count = *size*] end-exec

Parameters

cursor_name
The name of the cursor to be opened.

row_count
The number of rows moved in a network roundtrip, not the number fetched into the host variable.

size

The number of rows that are moved at the same time from Adaptive Server Enterprise to the client. The client buffers the rows until they are fetched by the application. This parameter allows you to tune network efficiency.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
      01     TITLE-ID     PIC X(6).
      01     BOOK-NAME    PIC X(25).
      01     BOOK-TYPE    PIC X(15).
 EXEC SQL END DECLARE SECTION END-EXEC.
      01     ANSWER       PIC X(1).
      ...
 DISPLAY "TYPE OF BOOKS TO RETRIEVE ? ".
 ACCEPT BOOK-TYPE.
 EXEC SQL DECLARE titlelist CURSOR FOR
      SELECT title_id, substring(title,1,25) FROM
           titles WHERE type = :BOOK-TYPE END-EXEC.

 EXEC SQL OPEN titlelist END-EXEC.
 PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
 EXEC SQL CLOSE titlelist END-EXEC.
 EXEC SQL DEALLOCATE CURSOR titlelist END-EXEC.
 EXEC SQL COMMIT WORK END-EXEC.

 FETCH-LOOP.
      EXEC SQL FETCH titlelist INTO :TITLE-ID, :BOOK-NAME END-EXEC.
      DISPLAY "TITLE ID : ", TITLE-ID
      DISPLAY "TITLE    : ", BOOK-NAME
      DISPLAY "UPDATE/DELETE THIS RECORD ? "
      ACCEPT ANSWER

      IF ANSWER = "U"
           DISPLAY "ENTER NEW TITLE :"
           ACCEPT BOOK-NAME
           EXEC SQL UPDATE titles SET title = :TITLE
                 WHERE CURRENT OF titlelist END-EXEC
      ELSE
           IF ANSWER = "D"
                EXEC SQL DELETE titles WHERE CURRENT OF
                      titlelist  END-EXEC
           END-IF
      END-IF.
 END-FETCH-LOOP.
```

Usage

- open executes the select statement given by the declare cursor statement and prepares results for the fetch statement.
- You can have an unlimited number of open cursors.
- A static cursor must be opened only in the file where the cursor is declared. The cursor can be closed in any file.
- The values of host variables embedded in the declare cursor statement are taken at open time.
- When specifying *cursor_name*, you can use the name of a deallocated static cursor. If you do, the precompiler declares and opens a new cursor having the same name as that of the deallocated cursor. Thus, the precompiler does not reopen the deallocated cursor but instead creates a new one. The results sets for the two cursors can differ.

open scrollable cursor

Description — Opens a previously declared static cursor.

Syntax — EXEC SQL OPEN <cursor_name> [*ROW_COUNT* = *size*] END-EXEC

Parameters

size
Specified as the pre-fetch count. The value is the same as the host array size.

ROW_COUNT
Specified only when host arrays are used as host variables.

Usage — The *size* value is the same as the host array size.

See also — scroll fetch, declare

prepare

Description — Declares a name for a dynamic SQL statement buffer.

Syntax — exec sql [at *connection_name*] prepare *statement_name* from {:*host_variable* | "*string*"} end-exec

Parameters

statement_name

An identifier used to reference the statement.

The *statement_name* must uniquely identify the statement buffer and must conform to the SQL identifier rules for naming variables. It can also be a *host_variable* string containing a valid SQL identifier. *statement_name* must not be longer than 255 characters.

host_variable

A character-string host variable that contains an executable SQL statement. Place dynamic parameter markers (“?”) anywhere in the select statement where a host variable value will be substituted.

string

A literal string that can be used in place of *host_variable.*

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     DEMO-BUFFER     PIC X(120).
           01     STATE          PIC X(3).
      EXEC SQL END DECLARE SECTION END-EXEC.
           ...
* The 'select into table' statement returns no results
* to the program, so it does not need a cursor.

      MOVE "select * into #work from authors where state = ?" TO
 -               DEMO-BUFFER.

      DISPLAY "STATE ? ".
      ACCEPT STATE.

      EXEC SQL PREPARE dynstmt FROM :DEMO-BUFFER END-EXEC.
      EXEC SQL EXECUTE dynstmt USING :STATE END-EXEC.

      EXEC SQL DEALLOCATE PREPARE dynstmt END-EXEC.
```

Usage

- In the current implementation, Sybase creates a temporary stored procedure for a dynamic SQL statement stored in a character string literal or host variable.
- prepare sends the contents of *host_variable* to the Adaptive Server Enterprise to convert into a temporary stored procedure. This temporary stored procedure remains in tempdb on Adaptive Server Enterprise until the statement is deallocated or the connection is disconnected.

- The scope of *statement_name* is global to your program but local to the connection *connection_name*. The statement persists until the program either deallocates it or closes the connection.
- prepare is valid with Dynamic SQL methods 2, 3, and 4.
- With method 2, (prepare and execute), an execute statement substitutes values from host variables, if any, into the prepared statement and sends the completed statement to Adaptive Server Enterprise. If there are no host variables to substitute and no results, you can use execute immediate, instead.
- With method 3, prepare and fetch, a declare cursor statement associates the saved select statement with a cursor. An open statement substitutes values from host variables, if any, into the select statement and sends the result to Adaptive Server Enterprise for execution.
- With methods 2, 3, and 4, prepare and fetch with parameter descriptors, the dynamic parameter descriptors, represented by question marks ("?"), indicate where host variables will be substituted.
- A prepared statement must be executed on the same connection on which it was prepared. If the prepared statement is used to declare a cursor, all operations on that cursor use the same connection as the prepared statement.
- The statement in *host_variable* can contain dynamic parameter markers that indicate where to substitute values of host variables into the statement.

See also

declare cursor, execute, execute immediate, deallocate prepare

rollback

Description

Rolls a transaction back to a savepoint inside the transaction or to the beginning of the transaction.

Syntax

exec sql [at *connection_name*]
rollback [transaction | tran | work]
[*transaction_name* | *savepoint_name*] end-exec

Parameters

transaction | trans | work

The keywords transaction, trans, and work are interchangeable in the rollback statement, but only work is ANSI-compliant.

transaction_name
The name of the transaction being rolled back.

savepoint_name
The name assigned to the savepoint in a save transaction statement. If you omit *savepoint_name*, Adaptive Server rolls back the entire transaction.

Examples

```
          ...
     EXEC SQL CONNECT "user" IDENTIFIED BY "password"
          AT connect1 USING "srvname" END-EXEC.
          ...
     EXEC SQL AT connect1 UPDATE test SET col1 = 'x' END-EXEC.
     IF SQLCODE = 0
          DISPLAY "ROWS UPDATED = ",SQLERRD(3)
     ELSE
DISPLAY "AN ERROR OCCURED -",SQLERRMC
          ESQL SQL AT connect1 ROLLBACK TRANSACTION END-EXEC
     END-IF.
```

Usage

- This reference page mainly describes aspects of the Transact-SQL rollback statement that differ when used with Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- Transaction names and savepoint names must conform to the Transact-SQL rules for identifiers.
- Transaction names and savepoints are Transact-SQL extensions; they are not ANSI-compliant. Do not use a transaction name or savepoint name with the ANSI-compliant keyword work.

See also begin transaction, commit

select

Description Retrieves rows from database objects.

Syntax
exec sql [at *connect_name*]
select *select_list*
into *destination*
from *table_name*… end-exec

Parameters *select_list*
Same as *select_list* in the Transact-SQL select statement, except that *select_list* cannot perform variable assignments in Embedded SQL.

destination

A table or a series of one or more Embedded SQL host variables. Each host variable must first be defined in a previous declare section. *Indicator variables* can be associated with the host variables.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     LNAME      PIC X(25).
           01     FNAME      PIC X(25).
           01     PHONE      PIC X(15).
           01     AU-ID      PIC X(12).
      EXEC SQL END DECLARE SECTION END-EXEC.

           ...


      DISPLAY "AUTHOR ID ? ".
      ACCEPT AU-ID.

      EXEC SQL SELECT au_lname, au_fname, phone
                INTO :LNAME, :FNAME, :PHONE
            FROM authors
            WHERE au_id = :AU-ID END-EXEC.

      IF SQLCODE = 100
 DISPLAY "COULD NOT LOCATE AUTHOR ",AU-ID
      ELSE
           DISPLAY "DETAIL RECORD FOR AUTHOR: ", AU-ID
                DISPLAY "NAME  :",LNAME, " ", FNAME
                DISPLAY "PHONE :",PHONE
      END-IF.
```

Usage

- This reference page mainly describes aspects of the Transact-SQL select statement that differ when the statement is used in Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- The compute clause of the Transact-SQL select statement cannot be used in Embedded SQL programs.
- Host variables in a select statement are input variables only, except in the statement's into clause. Host variables in the into clause are output variables.
- Previously declared input host variables can be used anywhere in a select statement that a literal value or Transact-SQL variable is allowed. Indicator variables can be associated with input host variables to specify null values.

- If a select statement returns more than one row, each host variable in the statement's into clause must be an array with enough space for all the rows. Otherwise, you must use a cursor to bring the rows back one at a time.

See also declare cursor

set connection

Description Causes the specified existing connection to become the current connection.

Syntax set connection {*connection_name* | DEFAULT} end-exec

Parameters *connection_name*
The name of an existing connection that you want to become the current connection.

default
Specifies that the unnamed default connection is to become the current connection.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
          01     MYID     PIC X(33).
     EXEC SQL END DECLARE SECTION END-EXEC.
          ...
     EXEC SQL CONNECT "user1" AT connect1 USING "SERVER1" END-EXEC.
     EXEC SQL CONNECT "user2" AT connect2 USING "SERVER2" END-EXEC.

* The next statement executes on connect2, because that was the
* last connection made.

     EXEC SQL SELECT user_name() INTO :MYID END-EXEC.

     DISPLAY "The user connected to SERVER2 is: ",MYID.

* Explicitly set the connection to now use to connect1.

     EXEC SQL SET CONNECTION connect1 END-EXEC.

* The following statement will execute on connect1.

     EXEC SQL SELECT user_name() INTO :MYID END-EXEC.

     DISPLAY "The user connected to SERVER1 is: ",MYID.
```

Usage

- The set connection statement specifies the current connection for all subsequent SQL statements, except those preceded by the exec sql clause at.
- A set connection statement remains in effect until you choose a different current connection by using the set connection statement again.

See also

at connection_name, connect

set descriptor

Description

Inserts or updates data in a SQL descriptor.

For a list of possible SQL descriptor datatypes, see Table 9-5 on page 175.

Syntax

```
exec sql set descriptor descriptor_name
 {count = host_variable} |
 {value item_number {item_name =
  :host_variable}[,...] end-exec
```

Parameters

descriptor_name
The name of the SQL descriptor that contains information about the dynamic parameter markers in a prepared statement.

count
The number of dynamic parameter specifications to be described.

host_variable
A host variable defined in a declare section.

item_number
Represents the *n*th occurrence of either a dynamic parameter marker or a select column.

item_name
Represents the attribute information of either a dynamic parameter marker or a select list column. Table 9-4 lists the values for *item_name*.

Table 9-4: Values for item_name

Value	Description
data	Value for the dynamic parameter marker or target associated with the specified SQL descriptor. If indicator is negative, this field is undefined.
length	The length, in characters, of the dynamic parameter marker of target for the specified SQL descriptor.
precision	An integer specifying the total number of digits of precision for the CS_NUMERIC variable.
scale	An integer specifying the total number of digits after the decimal point for the CS_NUMERIC variable.
type	The datatype of this column (item number) in the row. For values, see Table 9-5 on page 175.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     TITLE-ID     PIC X(6).
           01     SALES1       PIC S9(9).
           01     SALES2       PIC S9(9).
           01     ROYALTY      PIC S9(9) COMP.
      EXEC SQL END DECLARE SECTION END-EXEC.
           ...
      EXEC SQL ALLOCATE DESCRIPTOR roy_desc WITH MAX 3 END-EXEC.
      EXEC SQL PREPARE  getroylty FROM "SELECT royalty FROM roysched
         WHERE title_id = ? and lorange <= ?AND hirange > ?"
      END-EXEC.

      MOVE "BU1032" TO TITLE-ID.
      MOVE 1000     TO SALES1.
      MOVE 10           TO SALES2.

      EXEC SQL SET DESCRIPTOR roy_desc VALUE 1 DATA = :TITLE-ID END-EXEC.
      EXEC SQL SET DESCRIPTOR roy_desc VALUE 2 DATA = :SALES1   END-EXEC.
      EXEC SQL SET DESCRIPTOR roy_desc VALUE 3 DATA = :SALES2   END-EXEC.

      EXEC SQL EXECUTE getroylty INTO :ROYALTY USING SQL
                DESCRIPTOR roy_desc END-EXEC.

      DISPLAY "ROYALTY = ", ROYALTY.
```

Usage

An Embedded SQL program passes attribute and value information to Client-Library, which holds the data in the specified SQL descriptor until the program issues it a request to execute a statement.

See also — allocate descriptor, describe input, describe output, execute, fetch, get descriptor, open(dynamic cursor)

update

Description — Modifies data in rows of a table.

Syntax

exec sql [at *connection_name*] update *table_name*
set [*table_name*]
column_name1 = {*expression1*
| NULL | (*select_statement*)}
[, *column_name2* =
{*expression2* | NULL
| (*select_statement*)}]…
[from *table_name*
[, *table_name*]…
[where {*search_conditions* | current of *cursor_name*}]
end-exec

Parameters

table_name
The name of a table or view, specified in any format that is valid for the update statement in Transact-SQL.

Examples

```
EXEC SQL BEGIN DECLARE SECTION END-EXEC.
           01     STORE-NAME        PIC X(40).
           01     DISC-TYPE         PIC X(40).
           01     LOWQTY            PIC S9(9) COMP.
           01     HIGHQTY           PIC S9(9) COMP.
           01     DISCOUNT          PIC S9(9) COMP.
      EXEC SQL END DECLARE SECTION END-EXEC.
           ...
      EXEC SQL DECLARE upd_cursor CURSOR FOR
           SELECT s.stor_name, d.discounttype, d.lowqty,
                  d.highqty  , d.discount
           FROM   stores    s, discounts d
           WHERE  s.stor_id  = d.stor_id END-EXEC.

      EXEC SQL OPEN upd_cursor END-EXEC.
      PERFORM FETCH-LOOP UNTIL SQLCODE = 100.
      EXEC SQL CLOSE upd_cursor END-EXEC.
      EXEC SQL DEALLOCATE CURSOR upd_cursor END-EXEC.
      EXEC SQL COMMIT WORK END-EXEC.
           ...
```

```
        FETCH-LOOP.
     EXEC SQL FETCH upd_cursor INTO :STORE-NAME, :DISC-TYPE,:LOWQTY      ,
    :HIGHQTY,:DISCOUNT  END-EXEC.
               IF SQLCODE = 100
                    DISPLAY "NO MORE RECORDS TO FETCH. END OF PROGRAM RUN."
               ELSE
          DISPLAY "NEW DISCOUNT : "
                    ACCEPT DISCOUNT
                    EXEC SQL UPDATE discounts
                        SET discount = :DISCOUNT
                         WHERE CURRENT OF upd_cursor END-EXEC
               END-IF.
          END-FETCH-LOOP.
```

Usage

- This reference page mainly describes aspects of the Transact-SQL update statement that differ when the statement is used in Embedded SQL. See the *Adaptive Server Enterprise Reference Manual*.
- Host variables can appear anywhere in an expression or in any where clause.
- You can use the where clause to update selected rows in a table. Omit the where clause to update all rows in the table. Use where current of *cursor_name* to update the current row of an open cursor.
- When where current of *cursor_name* is specified, the statement must be executed on the connection specified in the open cursor statement. If the at *connection_name* clause is used, it must match the open cursor statement.

See also close, delete cursor, fetch, open, prepare

whenever

Description Specifies an action to occur whenever an executable SQL statement causes a specified condition.

Syntax exec sql whenever {sqlerror | not found | sqlwarning}
{continue | go to *label* | goto *label* |
stop | call *routine_name* [*args*]} end-exec

Parameters sqlerror

Specifies an action to take when an error is detected, such as a syntax error returned to the Embedded SQL program from Adaptive Server.

not found
: Specifies an action to take when a fetch or select into statement retrieves no data or when a searched update or delete statement affects no rows.

sqlwarning
: Specifies an action to take when a warning is received; for example, when a character string is truncated.

continue
: Take no action when the condition occurs.

go to | goto
: Transfer control to the program statement at the specified *label*.

label
: A host language statement label, such as a C label.

stop
: Terminate the Embedded SQL program when the condition occurs.

call
: Transfer control to a callable routine in the program, such as a user-defined function or subroutine.

routine_name
: A host language routine that can be called. The routine must be able to be called from the source file that contains the whenever statement. You may need to declare the routine as external to compile the Embedded SQL program.

args
: One or more arguments to be passed to the callable routine, using the parameter-passing conventions of the host language. The arguments can be any list of host variables, literals, or expressions that the host language allows. A space character should separate each argument from the next.

Examples

```
 EXEC SQL BEGIN DECLARE SECTION END-EXEC.
       01        LNAME      PIC X(15).
       01        FNAME      PIC X(15).
       01        PHONE      PIC X(15).
  EXEC SQL END DECLARE SECTION END-EXEC.

  EXEC SQL WHENEVER SQLERROR PERFORM ERR-PARA END-EXEC.
  EXEC SQL WHENEVER SQLWARNING PERFORM WARN-PARA END-EXEC.
* If there are no more records to process from the fetch, stop the
* program.
```

```
EXEC SQL WHENEVER NOT FOUND STOP END-EXEC.
      ...
EXEC SQL DECLARE au_list CURSOR FOR
            SELECT au_lname, au_fname, phone
            FROM authors
            ORDER BY au_lname END-EXEC.

EXEC SQL OPEN au_list END-EXEC.

PERFORM FETCH-LOOP UNTIL SQLCODE = 100 END-EXEC.
EXEC SQL CLOSE au_list END-EXEC.
      ...
FETCH-LOOP.
      EXEC SQL FETCH au_list INTO
                  :LNAME, :FNAME, :PHONE END-EXEC
      DISPLAY "LAST NAME  : ",LNAME
      DISPLAY "FIRST NAME : ",FNAME
      DISPLAY "PHONE      : ",PHONE
END-FETCH-LOOP.

 WARN-PARA.
      DISPLAY "Warning code is " SQLCODE.

      DISPLAY "Warning message is " SQLERRMC.
            ...
  WARN-PARA-END.
      EXIT.

  ERR-PARA.
*
* print the error code, the error message and the line number of
* the command that caused the error.
*

      DISPLAY "Error code is " SQLCODE.

      DISPLAY "Error message is " SQLERRMC.

      EXIT.
```

Usage

- The whenever statement causes the Embedded SQL precompiler to generate code following each executable SQL statement. The generated code includes the test for the condition and the host language statement or statements that carry out the specified action.

- The Embedded SQL precompiler generates code for the SQL statements that follow the whenever statement in the source file, including SQL statements in subroutines that are defined in the same source file.
- Use whenever…continue to cancel a previous whenever statement. The continue action causes the Embedded SQL precompiler to ignore the condition. To prevent infinite loops, use whenever…continue in an error handler before executing any Embedded SQL statements.
- When you use whenever…go to *label*, *label* must represent a valid location to resume execution. In C, for example, *label* must be declared in any routine that has executable SQL statements within the scope of the whenever statement. C does not allow a goto statement to jump to a label declared in another function.
- If you have a whenever statement in your program but you have not declared SQLCA or SQLSTATE status variables, the Embedded SQL precompiler assumes that you are using the SQLCODE variable. Be sure that SQLCODE is declared. Otherwise, the generated code will not compile.

SQL descriptor codes

Table 9-5 pertains to the SQL descriptor used for dynamic SQL statements. Sybase's use of dynamic SQL values conforms to the ANSI/ISO 185-92 SQL-92 standards. See the appropriate ANSI/ISO documentation.

Table 9-5: SQL descriptor datatype codes

ANSI SQL datatype	Code
bit	14
character	1
character varying	12
date, time	9
decimal	3
double precision	8
float	6
integer	4
numeric	2
real	7
smallint	5

Sybase-defined datatype	Client-Library code
smalldatetime	-9
money	-10
smallmoney	-11
text	-3
image	-4
tinyint	-8
binary	-5
varbinary	-6
long binary	-7
longchar	-2

Table 9-6: SQL descriptor identifier values

Value	Description
type	The datatype of this column (item number) in the row. For values, see Table 9-5 on page 175.
length	The length, in characters, of the dynamic parameter marker of target for the specified SQL descriptor.
returned_length	The length of char types of the values from the select column list.
precision	An integer specifying the total number of digits of precision for the CS_NUMERIC variable.

Value	Description
scale	An integer specifying the total number of digits after the decimal point for the CS_NUMERIC variable.
nullable	Equals 0 if the dynamic parameter marker can accept a null value; otherwise, equals 1.
indicator	Value for the indicator parameter associated with the dynamic parameter marker or target.
data	Value for the dynamic parameter marker or target associated with the specified SQL descriptor. If indicator is negative, this field is undefined.
name	The name of the specified SQL descriptor containing information about the dynamic parameter markers.

CHAPTER 10

Open Client/Server Configuration File

Open Client/Server applications can easily be configured using the Open Client/Server configuration file. By default, the file is named *ocs.cfg* and is located in the *$SYBASE/$SYBASE_OCS/config* directory for UNIX and *%SYBASE%\%SYBASE_OCS%\ini* directory for Microsoft Windows.

Purpose of the Open Client/Server configuration file

The Open Client/Server configuration file provides a single location where all Open Client/Server application connections can be configured. Using the configuration file simplifies the tasks of establishing configuration standards and managing configuration changes.

Accessing the configuration functionality

This feature is available through two new command-line options of the initialize_application statement:

- -x – this option allows for external configuration. The application needs to initialize an application with a name. The Open Client/Server configuration file will have a section with this application name. Under this section, place all properties that need to be set for this application. The -x option is useful only when used with initialize_application. If initializing is not done, and the -x option is used, the default section of the configuration file will be accessed.
- -e – this option allows us to configure by SERVER NAME. No call to initialize_application is required. The server name will be used as a key to look up in the configuration file for properties to be set the section defined by the server name. This allows users to associate connection names with specific connection properties.

Note If INITIALIZE_APPLICATION is not the first Embedded SQL statement to be executed, external configuration properties will not be set. If it is the first Embedded SQL statement to be executed, then the external configuration options will be used for initialization.

Default settings

The following is the Open Client/Server configuration file with default settings. You can customize the file as needed.

```
[DEFAULT]


;This is the default section loaded by applications that use the
 ;external configuration feature, but which do not specify their
 ;own application name. Initially this section is empty.Defaults
 ;from all properties will be the same as earlier versions of
 ;Open Client libraries.


[ANSI_ESQL]


;This section defines configuration which an ANSI conforming
 ;Embedded SQL application should use to get ANSI-defined
 ;behavior from Adaptive Server Enterprises and Open Client libraries. This set
```

```
of
 ;configuration ;properties matches the set which earlier
 ;versions of Embedded SQL (version 10.0.x) automatically set for
 ;applications duringexecution of a CONNECT statement.



CS_CAP_RESPONSE=CS_RES_NOSTRIPBLANKS
 CS_EXTRA_INF=CS_TRUE
 CS_ANSI_BINDS=CS_TRUE
 CS_OPT_ANSINULL=CS_TRUE
 CS_OPT_ANSIPERM=CS_TRUE
 CS_OPT_STR_RTRUNC=CS_TRUE
 CS_OPT_ARITHABORT=CS_FALSE
 CS_OPT_TRUNCIGNORE=CS_TRUE
 CS_OPT_ISOLATION=CS_OPT_LEVEL3
 CS_OPT_CHAINXACTS=CS_TRUE
 CS_OPT_CURCLOSEONXACT=CS_TRUE
 CS_OPT_QUOTED_IDENT=CS_TRUE
 ;End of default sections
```

Syntax for the Open Client/Server configuration file

The syntax for the Open Client/Server configuration file matches the existing syntax for Sybase localization and configuration files supported by CS-Library with minor variations.

Syntax

- ; – Signifies a comment line.
- [section_name] – Section names are wrapped in square brackets. The Open Client/Server configuration file comes with sections named DEFAULT and ANSI_ESQL. The application name will be used as the section name for an application that has been compiled with the -x option. For an application that has been compiled with the -e option, the server name will be used for the section name. Any name can be used as a section name for those sections that contain settings that will be used in multiple sections. The following example shows a section arbitrarily named GENERIC, and how that section is included in other sections:

```
[GENERIC]
 CS_OPT_ANSINULL=CS_TRUE


[APP_PAYROLL]
 include=GENERIC
 CS_CAP_RESPONSE=CS_RES_NOSTRIPBLANKS


[APP_HR]
 include=GENERIC
 CS_OPT_QUOTED_IDENT=CS_TRUE
```

- entry_name=entry_value
  - Entry values can be anything: integers, strings, and so on. If an entry value line ends with '\'<newline>, the entry value continues to the next line.
  - White spaces are trimmed from the beginning and end of entry values.
  - If white spaces are required at the beginning or end of an entry value, wrap them in double quotes.
  - An entry that begins with a double quote must end with a double quote. Two double quote characters in a row within a quoted string represent a single double quote in the value string. If a newline is encountered within double quotes, it is considered to be literally part of the value.
  - Entry names and section names can consist of alphabetic characters (both uppercase and lowercase), the digits 0 - 9, and any of the following punctuation characters: ! " # $ % & ' ( ) * + , - . / : ; < > ? @ \ ^ _ ` { | } ~.

    Square brackets ([ ]), space, and equal sign (=) are not supported. The first letter MUST be alphabetic.
  - Entry and section names are case sensitive.
  - Include=*earlier_section*

    If a section contains the entry include, then the entire contents of that previously defined section are considered to be replicated within this section. In other words, the properties defined in the previous section are inherited by this section.

Note that the included section must have been defined before being included in another section. This allows the configuration file parsing to happen in a single pass and eliminates the need to detect recursive included directives.

If an included section in turn includes another section, the order of entry values is defined by a “depthfirst” search of the included sections.

Sections cannot include a reference to themselves. In other words, recursion is not possible because you must include a previously defined section—you cannot include the section being defined.

All direct entry values defined in a given section supersede any values that may have been included from another section. In the following example, CS_OPT_ANSINULL will be set to false in the APP.PAYROLL application. Note that the position of the include statement does not affect this rule.

```
[GENERIC]
 CS_OPT_ANSINULL=CS_TRUE


[APP_PAYROLL]
 CS_OPT_ANSINULL=CS_FALSE
 include=GENERIC
```

Sample programs

Consider the following scenario: An Embedded SQL program defines a cursor to retrieve rows from the titles table in the pubs2 database. The WHERE clause uses non-ANSI standard NULL checking. To clarify, IS NULL and IS NOT NULL are ANSI standards which is the default used by Embedded SQL programs. However, an Embedded SQL program wishing to use = NULL or != NULL will need to turn OFF ANSINULL behavior and use Transact-SQL syntax instead. If you wanted to make comparisons with NULLs in Transact-SQL syntax in Embedded SQL prior to version 11.1, you would need to make the following call:

```
EXEC SQL set ansinull off END-EXEC.
```

In the following example, no change is made to the Embedded SQL code, but the desired behavior is attained by setting appropriate properties in the Open Client/Server configuration file.

There are two versions of the same program listed below. One is to be used with the -e option and the other with the -x option.

Embedded SQL/COBOL sample programs

Perform the following before you use the sample programs:

- On IBM, set the SYBPLATFORM environment variable to “rs6000” for the Embedded SQL/COBOL makefile, provided to build sample programs.
- On Sun Solaris, set the SYBPLATFORM environment variable to “sun_svr4” for the Embedded SQL/COBOL makefile, provided to build sample programs.
- On HP, set the SYBPLATFORM environment variable to “hpux” for the Embedded SQL/COBOL makefile, provided to build sample programs.
- On HP Itanium, set the SYBPLATFORM environment variable to “hpia” for the Embedded SQL/COBOL makefile, provided to build sample programs.
- On Linux, set the SYBPLATFORM environment variable to “linux” for the Embedded SQL/COBOL makefile, provided to build sample programs.

Embedded SQL program version for use with the *-x* option

```
* ocs_ex.pco

 * Description  :
 * This program declares a cursor which retrieves rows from
 * the 'titles' table based on condition checking for NULLS
 * in the NON-ANSI style ( CS_OPT_ANSINULL = CS_FALSE ).
 * The program will be compiled using the -x option which will
 * use an external configuration file (ocs.cfg) based on the
 * name of the application. The name of the application is
 * defined at the time of INITIALIZING the application.
 *
 *
```

```
* Notes : Copy the file ocs.cfg in this directory to the $SYBASE direc-
*         tory or add the entries from the section TEST1 in this file
*         to your existing ocs.cfg file in the $SYBASE directory.
*         Compile the program using the pre-processor flag -x.
*         See the attached ocs.cfg file for details on the properties
*         being set.

     EXEC SQL INCLUDE SQLCA END-EXEC.

     EXEC SQL BEGIN DECLARE SECTION END-EXEC.
                  ...
   01    TITLE-ID          PIC X(6).
   01    PRICE             PIC X(30).
     EXEC SQL END DECLARE SECTION END-EXEC.
                  ...


     EXEC SQL INITIALIZE_APPLICATION APPLICATION_NAME
               = "TEST1" END-EXEC.

     EXEC SQL CONNECT :UID IDENTIFIED BY :PASS END-EXEC.
     EXEC SQL USE pubs2 END-EXEC.

* Declare and open the cursor for select
     EXEC SQL DECLARE title_list CURSOR FOR
                  SELECT title_id, price FROM titles
                   WHERE price != NULL END-EXEC.

     EXEC SQL OPEN title_list END-EXEC.

* Fetch the data into host variables.
     PERFORM FETCH-LOOP UNTIL  SQLCODE = 100.

                  ...

     EXEC SQL CLOSE title_list END-EXEC.
     EXEC SQL DEALLOCATE CURSOR title_list END-EXEC.

     STOP RUN.

 FETCH-LOOP.


    EXEC SQL FETCH title list INTO
                  :TITLE-ID,
                  :PRICE END-EXEC.
```

```
           ...


     END-IF.
```

Note Set the precompiler option in the makefile: cobpre -x.

The following is a sample configuration file for the preceding program:

```
[DEFAULT]
 ;

 [TEST1]
 ;This is name of the application set by INITIALIZE_APPLICATION. ;Therefore this
is the section that will be referred to a runtime.

 CS_OPT_ANSINULL=CS_FALSE

 ;The above option will enable comparisons of nulls in the NON-ANSI
 ;style.
```

Same Embedded SQL program with the *-e* option

```
* Program name: ocs_test.cp
 *
 * Description  : This program declares a cursor that retrieves rows
 * from the 'titles' table based on condition checking for NULLS
 * in the NON-ANSI style.
 * The program will be compiled using the -e option, which will
 * use the server name that the application connects to, as the
 * corresponding section to look up in the configuration file.
 *

      EXEC SQL INCLUDE SQLCA END-EXEC.

      EXEC SQL BEGIN DECLARE SECTION END-EXEC.
                    ...
    01    TITLE-ID          PIC X(6).
    01    PRICE             PIC X(30).
      EXEC SQL END DECLARE SECTION END-EXEC.
                    ...

      EXEC SQL CONNECT :UID IDENTIFIED BY :PASS END-EXEC.
      EXEC SQL USE pubs2 END-EXEC.
```

```
 * Declare and open the cursor for select
      EXEC SQL DECLARE title_list CURSOR FOR
                   SELECT title_id, price FROM titles
                    WHERE price != NULL END-EXEC.

      EXEC SQL OPEN title_list END-EXEC.

 * Fetch the data into host variables.
      PERFORM FETCH-LOOP UNTIL  SQLCODE = 100.

                   ...

      EXEC SQL CLOSE title_list END-EXEC.
      EXEC SQL DEALLOCATE CURSOR title_list END-EXEC.

      STOP RUN.

  FETCH-LOOP.


     EXEC SQL FETCH title list INTO
                   :TITLE-ID,
                   :PRICE END-EXEC.
           ...


     END-IF.
```

Note Precompiler option to set in the makefile: cobpre -e.

The following is a sample configuration file for the preceding program:

```
[DEFAULT]
 ;

 [SYBASE]
 ;This is name of the server that the application connect to. Therefore
 ;this is the section that will be referred to a runtime.
 ;
 CS_OPT_ANSINULL=CS_FALSE
 ;The above option will enable comparisons of nulls in the NON-ANSI
 ;style.
```

The above configuration files have been vastly simplified. A typical Open Client/Server configuration file would be in the following format:

```
[DEFAULT]
 ;
 [ANSI_ESQL]
 CS_CAP_RESPONSE=CS_RES_NOSTRIPBLANKS
 CS_EXTRA_INF=CS_TRUE
 CS_ANSI_BINDS=CS_TRUE
 CS_OPT_ANSINULL=CS_TRUE
 CS_OPT_ANSIPERM=CS_TRUE
 CS_OPT_STR_RTRUNC=CS_TRUE
 CS_OPT_ARITHABORT=CS_FALSE
 CS_OPT_TRUNCIGNORE=CS_TRUE
 CS_OPT_ISOLATION=CS_OPT_LEVEL3
 CS_OPT_CHAINXACTS=CS_TRUE
 CS_OPT_CURCLOSEONXACT=CS_TRUE
 CS_OPT_QUOTED_IDENT=CS_TRUE
 ;
 ;The following is a sample section showing how to alter standard
 ;configuration:
 ;
 [RELEVANT_SECION_NAME]
 ;
 ;Use most of the ANSI properties defined above,
 ;
 include=ANSI_ESQL

 ;but override some default properties

 CS_OPT_ANSINULL=CS_TRUE    ; enable non-ansi style null comparisons
 CS_OPT_CHAINXACTS=CS_FALSE ; run in autocommit mode
```

APPENDIX A

Precompiler Warning and Error Messages

The Embedded SQL precompiler generates the informational, warning, and error messages shown in this appendix's tables.

Understanding the codes in the tables

Use this key for decoding the "Severity" column in Tables A-1 through A-9:

- Information – no error or warning was detected, and the precompiler succeeded. The message is purely informational.
- Warning – a noncritical error was detected, but the program precompiled.
- Severe – an error occurred, and no code was generated. The precompilation failed.
- Fatal – a severe error occurred from which the precompiler cannot recover. No further attempt will be made to process your files. Precompiler exits.

Table A-1: Command line option messages

Message ID	Message text	Severity	Fix
M_COMPAT_INFO	Compatibility mode specified.	Information	No fix required.
M_DUPOPT	Duplicate command line option specified.	Severe	Do not duplicate the options specified on the command line remove the offending duplicate option.

Message ID	Message text	Severity	Fix
M_EXCFG_OVERRIDE	The switch *value* will have no effect because the external switch *value* has been specified.	Warning	When you use an external configuration file, you may override configuration options set on the command line. Choose one means of setting options.
M_INVALID_COMPAT	Unrecognized compatibility mode specified.	Information	No fix required.
M_INVALID_FILE_FMT	Invalid character in file *value* at line *value*.	Severe	Check to be sure that characters in the input file are valid and that you have correctly set the character set you want to use.
M_INVALID_FIPLEVEL	Invalid FIPS level specified.	Severe	Valid values are SQL-92E and SQL-89.
M_INVALID_SYNLEVEL	Invalid syntax checking level specified.	Severe	Valid values are NONE, SYNTAX, SEMANTIC.
M_INVLD_HLANG	Host Language specified is invalid.	Severe	Valid options are COB_MF1, COB_MF2, COB_RM1, COB_RM2, COB_LPI, COB_VAXVMS.
M_INVLD_OCLIB_VER	The Open Client Client-Library version is invalid.	Severe	The correct version string is "CS_VERSION_110" or later.
M_INVOPT	Option is invalid.	Severe	Invalid option specified. Substitute the correct value.
M_LABEL_SYNTAX	Security label is improperly specified; the proper format is ‘labelname= labelvalue’.	Severe	Use the allowed syntax.
M_MSGINIT_FAIL	Error initializing localized error messages.	Warning	Verify that the Sybase installation is complete and that there is a valid entry for the LANG variable in the *locales.dat* file.
M_MULTI_IN_USE_DEF_OUT	When precompiling multiple input files, you cannot specify output (Listing, SQL, or Language) file names.	Severe	Remove all -G, -L, and -O flags from the command line or precompile the files one at a time.

Message ID	Message text	Severity	Fix
M_NO_INPUT_FILE	Error: No input file is specified to be precompiled.	Severe	Specify an input file for precompilation. **Note** This error may occur if you precede the input file name with a flag (such as -G, for generate stored procedures), which takes an optional argument. To fix, put another flag in front of the input file name. For example, replace cpre -G file.pc with cpre -G -C*compilername*.
M_NO_PERSISTENT_COBOL	The option -p for persistent input host variables is not available.	Information	No fix required.
M_OPEN_INCLUDE	Unable to open the specified include file *file.*	Severe	The specified file is either not in the path or is missing the required read permission. Specify the path with the -I flag and verify the read permission.
M_OPEN_INPUT	Unable to open the specified input file *file*.	Severe	Check the validity of the path and file name specified. If the file name extension is not provided, the precompiler searches for the default extension.
M_OPEN_ISQL	Unable to open the specified ISQL file *file*.	Severe	Check the validity of the isql file name (the file in which the stored procedures are written). Verify that you have the write permission in the directory where the file is being created.
M_OPEN_LIST	Unable to open the specified listing file *file*.	Severe	Check the validity of the listing file name. Verify that you have write permission in the directory where the file is being created.

Message ID	Message text	Severity	Fix
M_OPEN_TARGT	Unable to open the specified target file *file*.	Severe	Check the validity of the output file name. Verify that you have write permission in the directory where the file is being created.
M_OPT_MUST_BE_PROVIDED	Option *value* must be provided.	Severe	Provide a value for option.
M_OPT_REINIT	Warning: *value* switch initialized multiple times.	Warning	The specified switch has been initialized multiple times. The second and subsequent values are ignored.
M_PATH_OFL	Error: Max allowed paths for "INCLUDE" files is 64 (OVERFLOWED).	Severe	The maximum allowed paths on the command line have been exceeded. Reduce the number of directories from which the *INCLUDE* files are fetched.
M_STATIC_HV_CNAME	Static cursor names cannot be host-variables: *line*.	Severe	Replace the host variable with a SQL identifier.
M_UNBALANCED_DQ	Unbalanced quotes in delimited identifier.	Severe	Balance the quote.
M_VMS_NO_PERSISTENT_ COBOL	The persistent option is not available.	Information	

Table A-2: First pass parser messages

Message ID	Message text	Severity	Fix
M_64BIT_INT	Warning: 64 bit integer host variables are not supported. Line *value*.	Warning	Use some other host variable type (float, numeric, or 32-bit integer). If necessary, copy the value between the host variable and the 64-bit program variable.
M_BLOCK_ERROR	Non-matching block terminator in *value* at line: *value*.	Severe	Correct your program syntax.
M_COB_INC_SQLDA	Error: the INCLUDE SQLDA statement is not valid in ESQL/COBOL.	Severe	Remove the invalid statement. See “About SQLDAs” on page 85 and “Using SYBSETSQLDA” on page 87.

Message ID	Message text	Severity	Fix
M_CONST_FETCH	Error: Attempted fetch into CONST storage class variable *value*.	Severe	You cannot fetch into a constant type. To fetch the value, remove the constant qualifier in its declaration.
M_DUP_HV	Duplicate host variable in *file* at line *line.*	Severe	Another host variable with the same name is already declared in the same block. Verify that each variable within a given block has a unique name.
M_DUP_STRUNION	Duplicate structure/union in *file* at *line*.	Severe	Another structure with the same name is already declared in the same block. Verify that each variable within a given block has a unique name.
M_IDENT_OR_STRINGVAR	Error: item must be a SQL-identifier or a string-type variable.	Severe	Verify that the connection, cursor, or statement name is of type string or SQL identifier.
M_IDENT_TOO_LONG	Error: Identifier *value* is too long (*value* bytes). Maximum size allowed is *value* bytes.	Severe	Verify that the identifier length is within the allowed limit. For SDK 15.0 and later, the maximum length of an identifier is 255 characters. For earlier versions, the maximum length is 132 characters.
M_ILL_LITERAL_USAGE	Error: Use of literal parameters to an RPC with an OUTPUT qualifier is not legal.	Severe	Do not use a literal as an OUTPUT parameter to a stored procedure.
M_ILL_PARAM_MODE	Error: Mixing calling modes in an rpc call in *file* at *line*.	Severe	Call the stored procedure with arguments passed by name or by position. Mixing these modes in the same call is illegal.
M_INDICVAR	Error: item must be an indicator-type variable.	Severe	Use a short integer.
M_INTVAR	Error: item must be an integer-type variable.	Severe	Use an integer.
M_INVLD_HV_BT	Cobol host variable: *value* of type: *value* is not supported.	Severe	Check the datatypes of the host variables. An unsupported type was detected.

Message ID	Message text	Severity	Fix
M_MISMATCHED_QUOTES	Error: mismatched quotes on hex literal *value*.	Severe	Make quotes match.
M_MULTIDIM_ARRAY	Error: at *line*. Multiple-dimensioned array variables are not supported.	Severe	Multiple-dimensional arrays are not supported. Break up an *m x n* array into *m* arrays of *n* elements each.
M_MULTI_RESULTS	Error: Embedded Query at line *line* returns multiple result sets.	Severe	Break the query into multiple queries, each returning one result set. Alternatively, rewrite the queries to fill a temporary table with all the values, then select from the temporary table, thus giving a single result set.
M_NODCL_NONANSI	Warning: Neither SQLCODE nor SQLCA declared in non-ANSI mode.	Warning	In non-ANSI mode, declare either SQLCA, SQLCODE, or both. Verify that the scope is applicable for all Embedded SQL statements within the program.
M_NOLITERAL	Error: Item may not be an unquoted name.	Severe	Use a quoted name or host variable.
M_NOSQUOTE	Error: Item may not be a single quoted string. Use double quotes.	Severe	Use double quotes.
M_NOT_AT_ABLE	An “at” clause is used with a statement type which does not allow it. This occurred at line *value*.	Severe	Remove the at clause from the specified statement.
M_NUMBER_OR_INDICVAR	Error: Item must be an integer or an indicator-type variable.	Severe	Use a literal integer or a short integer or CS_SMALLINT.
M_NUMBER_OR_INTVAR	Error: Item must be an integer constant or an integer type variable.	Severe	Unused. May be used to raise an error if some field in the dynamic SQL statements (such as MAX, Value *n*,) is not an integer type or an integer constant.
M_PARAM_RESULTS	Error: Embedded Query at line *line* returns unexpected parameter result sets.	Severe	Arises only during optional server syntax checking. Determine why the query is returning parameters, and rewrite it.

Message ID	Message text	Severity	Fix
M_PASS1_ERR	File *file*: Syntax errors in Pass 1: Pass 2 not done.	Information	Errors in Pass 1 resulted in an aborted precompilation. Correct Pass 1 errors, then proceed.
M_PTR_IN_DEC_SEC	Warning: Pointers are not yet supported in Declare section.	Warning	None.
M_QSTRING_OR_STRINGVAR	Error: Item must be a quoted string or a type string variable.	Severe	Verify that server name, user name, and password are either double-quoted strings or of type string.
M_SCALAR_CHAR	Error: Non-array character variable *value* is being used illegally as a host variable at line *line*.	Severe	Use a character array.
M_SQLCA_IGNR	Warning: Both SQLCODE and SQLCA declared: SQLCA ignored.	Warning	Remove one of the two declarations.
M_SQLCA_WARN	Warning: An INCLUDE SQLCA seen while in ANSI mode: SQLCA ignored.	Warning	None.
M_SQLCODE_UNDCL	Warning: SQLCODE not declared while in ANSI mode.	Warning	Declare SQLCODE.
M_STATE_CODE	Warning: Both SQLSTATE and SQLCODE declared: SQLCODE ignored.	Warning	Remove one of the two declarations.
M_STATE_SQLCA	Warning: Both SQLSTATE and SQLCA declared: SQLCA ignored.	Warning	Remove one of the two declarations.
M_STATUS_RESULTS	Error: Embedded Query at line *line* returns unexpected status result sets.	Severe	Arises only during optional server syntax checking. Determine why the query is returning status results and rewrite it.
M_STICKY_AUTOVAR	Warning: Automatic variable *value* used with sticky binds at line *line*. This may cause incorrect results or errors at runtime.	Warning	Be certain that your program logic will not allow errors in this case. Alternatively, use a static or global variable.
M_STICKY_REGVAR	Error: Register variable *value* cannot be used with sticky binds at line *line*.	Severe	Remove the register qualifier.

Message ID	Message text	Severity	Fix
M_STRUCT_NOTFOUND	Structure/union definition not found in scope in *file* at *line*.	Severe	Verify that the definition of the structure or union is within the scope of the specified line.
M_SYNTAX_PARSE	Syntax error in file *file* at *line*.	Severe	Check the indicated line number for a syntax error in the Embedded SQL grammar.
M_UNBALANCED_DQ	Unbalanced quotes in delimited identifier.	Severe	Balance the quotes.
M_UNDEF_ELM	Error *value*: illegal structure/ union element.	Severe	The specified element of the structure is not included in the structure definition. Correct the definition.
M_UNDEF_HV	Host variable *value* undefined.	Severe	Define the host variable in the proper place.
M_UNDEF_IV	Indicator variable *value* undefined.	Severe	Define the indicator variable in the proper place.
M_UNDEF_STR	Error structure *value* undefined.	Severe	Undefined structure on the specified line. Define the structure in the proper scope.
M_UNSUP	The *value*, feature is not supported in this version.	Fatal	This feature is not supported.

Table A-3: Second pass parser messages

Message ID	Message text	Severity	Fix
M_CURSOR_RD	The cursor *value* is redefined at line *line* in *file*.	Warning	A cursor with same name has already been declared. Use a different name.
M_HOSTVAR_MULTIBIND	Warning: host variable used as a bind variable *value* more than once per statement.	Warning	Do not use a host variable multiple times in a single fetch statement. You cannot fetch multiple results into one location. Client-Library causes the last value fetched to be put in the variable.
M_INVTYPE_IV	Indicator variable is an incorrect type.	Severe	The indicator variable should be of type CS_SMALLINT or of type INDICATOR.

Message ID	Message text	Severity	Fix
M_INVTYPE_V	Incorrect type of indicator variable found in structure *value*.	Fatal	All indicator variables in a structure must be of type CS_SMALLINT or INDICATOR.
M_INVTYPE_VI	Mismatch between number of structure elements in the indicator structure *value* and hostvar structure *value*.	Fatal	The number of elements in an indicator structure must be the same as the number of elements in the hostvar structure.
M_INVTYPE_VII	Mismatch between number of elements in the indicator array *value* and hostvar structure *value*.	Fatal	The number of elements in an indicator array must be the same as the number of elements in the hostvar structure.
M_PARSE_INTERNAL	Internal parser error at line *line*. Please contact a Sybase representative.	Fatal	Immediately report this internal consistency parser error to Sybase Technical Support.
M_SQLCANF	'INCLUDE SQLCA' statement not found.	Warning	Add the statement.
M_TAB_IN_LIT	Warning: TAB character in quoted string converted to space. (This warning will only appear once.)	Warning	If this is a problem, manually expand quoted <tabs> to spaces in your queries.
M_WHEN_ERROR	Unable to find the SQL statement 'WHENEVER SQLERROR'.	Warning	Add WHENEVER SQLERROR statement ,or use the command line option to suppress warning and INTO messages (see the *Open Client and Open Server Programmers Supplement*).
M_WHEN_NF	Unable to find the SQL statement "WHENEVER NOT FOUND".	Warning	Enter a WHENEVER NOT FOUND statement, or use the command line option to suppress warning and INTO messages (see the *Open Client and Open Server Programmers Supplement*).

Message ID	Message text	Severity	Fix
M_WHEN_WARN	Unable to find the SQL statement "WHENEVER NOT FOUND".	Warning	Enter a WHENEVER WARNING statement, or use the command line option to suppress warning and INTO messages (see the *Open Client and Open Server Programmers Supplement*).

Table A-4: Code generation messages

Message ID	Message text	Severity	Fix
M_INCLUDE_PATHLEN	An included or copied file path was too long. Leaving the path off the generated file name: *value*.	Warning	Use links or move the file to a shorter path.
M_WRITE_ISQL	Unable to write to the isql file. Return code: *value*.	Fatal	Verify your permission to create and write to the isql file and in the directory. Also, verify that the file system is not full.
M_WRITE_TARGT	Unable to write to the target file. Return code: *value*.	Fatal	Unable to write to the target file. Verify your permission to create and write to a file in the directory where the precompiler is generating the target file. Also, verify that the file system is not full.

Table A-5: FIPS flag messages

Message ID	Message text	Severity	ANSI extension
M_FIPS_ARRAY	FIPS-flagger Warning: ANSI extension ARRAY type at *line*.	Information	Arrays. As for all FIPS messages, do not use this feature if you need to be ANSI-compliant.
M_FIPS_DATAINIT	FIPS-flagger Warning: ANSI extension Data Initialization at *line*.	Information	Data initialization.
M_FIPS_GPITEM	FIPS-Flagger Warning: ANSI extension group item syntax. (line *line*).	Information	

Message ID	Message text	Severity	ANSI extension
M_FIPS_SQLDA	FIPS-flagger Warning: ANSI extension sqlda. (line *line*).	Information	The SQLDA structure.
M_FIPS_STMT	FIPS-flagger Warning: ANSI extension statement (line *line*)	Information	The statement at this line is an extension.
M_FIPS_SYBTYPE	FIPS-flagger Warning: ANSI extension Sybase SQL-Type *line*.	Information	Sybase-specific datatypes.

Table A-6: Internal error messages

Message ID	Message text	Severity	Fix
M_ALC_MEMORY	Unable to allocate a block of memory.	Fatal	Check system resources.
M_FILE_STACK_OVFL	File stack overflow: Max allowed nesting is *value*.	Fatal	The file stack overflowed while trying to process the nested INCLUDE statement. Do not exceed the nested depth maximum of 32.
M_INTERNAL_ERROR	Fatal Internal Error at file *file* line *line*: Argument inconsistency error. Please contact Sybase representative.	Fatal	This is an internal error. Contact your Sybase representative.

Table A-7: Platform and language messages

Message ID	Message text	Severity	Fix
M_LONGLINE	A line being printed is too long and cannot be broken.	Warning	Shorten the line to be printed.

Table A-8: Sybase and Client-Library messages

Message ID	Message text	Severity	Fix
M_COLMCNT	The bind count of the *bind variable count* and the column count of result set are incompatible.	Warning	The number of returned columns is different from the number of results columns returned with the bind variable types and number.

Message ID	Message text	Severity	Fix
M_COLVARLM	The host variable *name* length *value* is less than the column length of *value*.	Warning	The host variable may not be able to hold the fetched column. Check the column length and adjust the length of the host variable accordingly.
M_COLVARPS	The host variable *name* precision and scale: *value* are different from the column's precision *value* and scale: *value*.	Warning	The precision and scale of the host variable is different from that of the column being fetched or inserted into. Make the scale and precision compatible.
M_COLVARTM	Open Client unable to convert type *value* to type *value* for host variable name.	Warning	Illegal type. Use cs_convert, as Open Client cannot convert by default.
M_CTMSG	Client Library message: *value*.	Information	None. If needed, contact Sybase Technical Support for assistance.
M_OCAPI	Error during execution of the Open Client API *value*. Error: *value*.	Warning	Depending on the context in which this warning occurs, you may be required to take corrective action before proceeding.
M_OPERSYS	Operating system error: *value* occurred during execution of the Open Client API.	Warning	An operating system error occurred. See the systems administrator.
M_PRECLINE	Warning(s) during check of query on line *value*.	Information	Examine the query for problems.
M_SYBSERV	Sybase Server error. Server: *value*. Message: name.	Warning	Check the syntax of the statement sent to the Server which caused this error. Verify that all resources are available in Adaptive Server Enterprise to process the SQL statement.

Table A-9: Runtime messages

SQLSTATE Code	Message text	Severity	Fix
ZZ000	Unrecoverable error occurred.	Fatal	Immediately report this error to Sybase Technical Support.
ZA000	Internal error occurred.	Fatal	Immediately report this error to Sybase Technical Support.
ZD000	Unexpected CS_COMPUTE_RESULT received.	Severe	Embedded SQL cannot retrieve compute results. Rewrite the query so it does not return them.
ZE000	Unexpected CS_CURSOR_RESULT received.	Severe	Verify that the value returned by the CS_LIBRARY routine is valid. Consult your CS-Library documentations for details.
ZF000	Unexpected CS_PARAM_RESULT received.	Severe	Verify that the value returned by the CS_LIBRARY routine is valid. Consult your CS-Library documentation for details.
ZG000	Unexpected CS_ROW_RESULT received.	Severe	Verify that the value returned by the CS_LIBRARY routine is valid. Consult your CS-Library documentation for details.
ZB000	No message(s) returned for SQLCA, SQLCODE, or SQLSTATE.	Information	Informational message. No action is required.
ZC000	Connection has not been defined yet.	Severe	Enter a valid connect statement.

SQLSTATE Code	Message text	Severity	Fix
ZH000	Unexpected CS_STATUS_RESULT received.	Severe	Verify that the value returned by the CS_LIBRARY routine is valid. Consult your CS-Library documentation for details.
ZI000	Unexpected CS_DESCRIBE_RESULT received.	Severe	Verify that the value returned by the CS_LIBRARY routine is valid. Consult your CS-Library documentation for details.
22005	Data exception—error in assignment of item descriptor type.	Severe	Enter a valid descriptor type.
ZJ000	Memory allocation failure.	Severe	There is an insufficient amount of memory to allocate to this operation.
ZK000	Adaptive Server Enterprise must be version 10 or later.	Severe	Verify that your installation has an installed, functioning copy of Adaptive Server Enterprise 10.0 or later. If you do not have Adaptive Server Enterprise 10.0 or later, have your installation's designated person contact Sybase Technical Support.
ZM000	Error initializing Client Library.	Severe	Check your *$SYBASE* set-up.
ZN000	Error taking a mutex.	Severe	Unused.

SQLSTATE Code	Message text	Severity	Fix
08002	Connection name in use.	Severe	Check your program logic: Are you re-opening an open connection? Or use a new name for the second connection. **Note** You cannot have two DEFAULT connections.
ZO000	HA FAILOVER has occurred.	Information	No action required.

Glossary

Adaptive Server Enterprise
A server in Sybase's client/server architecture. Adaptive Server Enterprise manages multiple databases and multiple users, keeps track of the actual location of data on disks, maintains mapping of logical data description to physical data storage, and maintains data and procedure caches in memory.

array
A structure composed of multiple identical variables that can be individually addressed.

array binding
The process of binding a result column to an array variable. At fetch time, multiple rows' worth of the column are copied into the variable.

batch
A group of commands or statements:

A Client-Library command batch is one or more Client-Library commands terminated by an application's call to ct_send. For example, an application can batch together commands to declare, set rows for, and open a cursor.

A Transact-SQL statement batch is one or more Transact-SQL statements submitted to Adaptive Server Enterprise by means of a single Client-Library command or Embedded SQL statement.

browse mode
A method that DB-Library and Client-Library applications can use to browse through database rows, updating their values one row at a time. Cursors provide similar functionality and are generally more portable and flexible.

bulk copy
A utility for copying data in and out of databases. Also called bcp.

callback event
In Open Client and Open Server, an occurrence that triggers a callback routine.

callback routine
A routine that Open Client or Open Server calls in response to a triggering event, known as a callback event.

capabilities
Determine the types of client requests and server responses permitted for a client/server connection.

character set — A set of specific (usually standardized) characters with an encoding scheme that uniquely defines each character. ASCII and ISO 8859-1 (Latin 1) are two common character sets.

character set conversion — Changing the encoding scheme of a set of characters on the way into or out of a server. Conversion is used when a server and a client communicating with it use different character sets. For example, if Adaptive Server Enterprise uses ISO 8859-1 and a client uses Code Page 850, character set conversion must be turned on so that both server and client interpret the data passing back and forth in the same way.

client — In client/server systems, the part of the system that sends requests to servers and processes the results of those requests.

Client-Library — Part of Open Client, a collection of routines for use in writing client applications. Client-Library is a library designed to accommodate cursors and other advanced features in the Sybase product line.

code set — See *character set*.

collating sequence — See *sort order*.

command — In Client-Library, a server request initiated by an application's call to ct_command, ct_dynamic, or ct_cursor and terminated by the application's call to ct_send.

command structure — A hidden Client-Library structure (CS_COMMAND) that Client-Library applications use to send commands and process results.

connection structure — A hidden Client-Library structure (CS_CONNECTION) that defines a client/server connection within a context.

context structure — A CS-Library hidden structure (CS_CONTEXT) that defines an application "context," or operating environment, within a Client-Library or Open Server application. The CS-Library routines cs_ctx_alloc and cs_ctx_drop allocate and drop a context structure, respectively.

conversion — See *character set conversion*.

CS-Library — Included with both the Open Client and Open Server products, a collection of utility routines that are useful to both Client-Library and Server-Library applications.

current row — With respect to cursors, the row to which a cursor points. A fetch against a cursor retrieves the current row.

cursor — A symbolic name that is associated with a SQL statement.

	In Embedded SQL, a cursor is a data selector that passes multiple rows of data to the host program, one row at a time.
database	A set of related data tables and other database objects that are organized to serve a specific purpose.
datatype	A defining attribute that describes the values and operations that are legal for a variable.
DB-Library	Part of Open Client, a collection of routines for use in writing client applications.
deadlock	A situation that arises when two users, each having a lock on one piece of data, attempt to acquire a lock on the other's piece of data. Adaptive Server Enterprise detects deadlocks and resolves them by killing one user's process.
default	Describes the value, option, or behavior that Open Client/Server products use when none is explicitly specified.
default database	The database that a user gets by default when he or she logs in to a database server.
default language	1. The language that Open Client/Server products use when an application does no explicit localization. The default language is determined by the "default" entry in the locales file. 2. The language that Adaptive Server Enterprise uses for messages and prompts when a user has not explicitly chosen a language.
Dynamic SQL	Allows an Embedded SQL or Client-Library application to execute SQL statements containing variables whose values are determined at runtime.
error message	A message that an Open Client/Server product issues when it detects an error condition.
event	An occurrence that prompts an Open Server application to take certain actions. Client commands and certain commands within Open Server application code can trigger events. When an event occurs, Open Server calls either the appropriate event-handling routine in the application code or the appropriate default event handler.
event handler	In Open Server, a routine that processes an event. An Open Server application can use the default handlers Open Server provides or can install custom event handlers.

exposed structure A structure whose internals are exposed to Open Client/Server programmers. Open Client/Server programmers can declare, manipulate, and de-allocate exposed structures directly. The CS_DATAFMT structure is an example of an exposed structure.

extended transaction In Embedded SQL, a transaction composed of multiple Embedded SQL statements.

FIPS Federal Information Processing Standards. If FIPS flagging is enabled, Adaptive Server Enterprise or the Embedded SQL precompiler issue warnings when a non-standard extension to a SQL statement is encountered.

gateway A gateway is an application that acts as an intermediary for clients and servers that cannot communicate directly. Acting as both client and server, a gateway application passes requests from a client to a server and returns results from the server to the client.

hidden structure A hidden structure is a structure whose internals are hidden from Open Client/Server programmers. Open Client/Server programmers must use Open Client/Server routines to allocate, manipulate, and de-allocate hidden structures. The CS_CONTEXT structure is an example of a hidden structure.

host language The programming language in which an application is written.

host program In Embedded SQL, the host program is the application program that contains the Embedded SQL code.

host variable In Embedded SQL, a variable that enables data transfer between Adaptive Server Enterprise and the application program. See also *indicator variable*, *input variable*, *output variable*, *result variable*, and *status variable*.

indicator variable A variable whose value indicates special conditions about another variable's value or about fetched data.

When used with an Embedded SQL host variable, an indicator variable indicates when a database value is null.

input variable A variable that is used to pass information to a routine, a stored procedure, or Adaptive Server Enterprise.

interfaces file A file that maps server names to transport addresses. When a client application calls ct_connect or dbopen to connect to a server, Client-Library or DB-Library searches the interfaces file for the server's address. Note that not all platforms use the interfaces file. On these platforms, an alternate mechanism directs clients to server addresses.

isql script file — In Embedded SQL, one of the three files the precompiler can generate. An isql script file contains precompiler-generated stored procedures, which are written in Transact-SQL.

key — A subset of row data that uniquely identifies a row. Key data uniquely describes the *current row* in an open cursor.

keyword — A word or phrase that is reserved for exclusive use in Transact-SQL or Embedded SQL. Also called a *reserved word*.

listing file — In Embedded SQL, one of the three files the precompiler can generate. A listing file contains the input file's source statements and informational, warning, and error messages.

locales file — A file that maps locale names to language/character set pairs. Open Client/Server products search the locales file when loading localization information.

locale name — A character string that represents a language/character set pair. Locale names are listed in the *locales file*. Sybase predefines some locale names, but a system administrator can define additional locale names and add them to the locales file.

locale structure — A CS-Library hidden structure (CS_LOCALE) that defines custom localization values for a Client-Library or Open Server application. An application can use a CS_LOCALE to define the language, character set, datepart ordering, and sort order it will use. The CS-Library routines cs_loc_alloc and cs_loc_drop allocate and drop a locale structure.

localization — The process of setting up an application to run in a particular national language environment. An application that is localized typically generates messages in a local language and character set and uses local date, time, and datetime formats.

login name — The name a user uses to log in to a server. An Adaptive Server Enterprise login name is valid if Adaptive Server Enterprise has an entry for that user in the system table *syslogins*.

message number — A number that uniquely identifies an error message.

message queue — In Open Server, a linked list of message pointers through which threads communicate. Threads can write messages into and read messages from the queue.

multi-byte character set — A character set that includes characters encoded using more than 1 byte. EUC JIS and Shift-JIS are examples of multibyte character sets.

mutex A mutual exclusion semaphore. This is a logical object that an Open Server application uses to ensure exclusive access to a shared object.

null Having no explicitly assigned value. NULL is not equivalent to zero or to blank. A value of NULL is not considered to be greater than, less than, or equivalent to any other value, including another value of NULL.

Open Server A Sybase product that provides tools and interfaces for creating custom servers.

Open Server application A custom server constructed with Open Server.

output variable In Embedded SQL, a variable that passes data from a stored procedure to an application program.

parameter 1. A variable that is used to pass data to and retrieve data from a routine.

2. An argument to a stored procedure.

passthrough mode When in passthrough mode, a gateway relays Tabular Data Stream™ (TDS) packets between a client and a remote data source without unpacking the packets' contents.

property A named value stored in a structure. Context, connection, thread, and command structures have properties. A structure's properties determine how it behaves.

query 1. A data retrieval request; usually a select statement.

2. Any SQL statement that manipulates data.

registered procedure In Open Server, a collection of C statements stored under a name. Open Server-supplied registered procedures are called *system registered procedures*.

remote procedure call 1. One of two ways in which a client application can execute an Adaptive Server Enterprise stored procedure. (The other is with a Transact-SQL execute statement.) A Client-Library application initiates a remote procedure call command by calling ct_command. A DB-Library application initiates a remote procedure call command by calling dbrpcinit.

2. A type of request a client can make of an Open Server application. In response, Open Server either executes the corresponding registered procedure or calls the Open Server application's RPC event handler.

3. A stored procedure executed on a different server from the server to which the user is connected.

result variable — In Embedded SQL, a variable which receives the results of a select or fetch statement.

server — In client/server systems, the part of the system that processes client requests and returns results to clients.

Server-Library — A collection of routines for use in writing Open Server applications.

sort order — Used to determine the order in which character data is sorted. Also called *collating sequence*.

SQLCA — 1. In an Embedded SQL application, SQLCA is a structure that provides a communication path between Adaptive Server Enterprise and the application program. After executing each SQL statement, Adaptive Server Enterprise stores return codes in SQLCA.

2. In a Client-Library application, SQLCA is a structure that the application can use to retrieve Client-Library and server error and informational messages.

SQLCODE — 1. In an Embedded SQL application, SQLCODE is a structure that provides a communication path between Adaptive Server Enterprise and the application program. After executing each SQL statement, Adaptive Server Enterprise stores return codes in SQLCODE. A SQLCODE can exist independently or as a variable within a SQLCA structure.

2. In a Client-Library application, SQLCODE is a structure that the application can use to retrieve Client-Library and server error and informational message codes.

statement — In Transact-SQL or Embedded SQL, an instruction that begins with a keyword. The keyword names the basic operation or command to be performed.

status variable — In Embedded SQL, a variable that receives the return status value of a stored procedure, thereby indicating the procedure's success of failure.

stored procedure — In Adaptive Server Enterprise, a collection of SQL statements and optional control-of-flow statements stored under a name. Adaptive Server Enterprise-supplied stored procedures are called *system procedures*.

System Administrator — The user in charge of Adaptive Server Enterprise system administration, including creating user accounts, assigning permissions, and creating new databases. On Adaptive Server Enterprise, the System Administrator's login name is "sa".

system descriptor — In Embedded SQL, a system descriptor is an area of memory that holds a description of variables used in Dynamic SQL statements.

system procedures Stored procedures that Adaptive Server Enterprise supplies for use in system administration. These procedures are provided as shortcuts for retrieving information from system tables, or as mechanisms for accomplishing database administration and other tasks that involve updating system tables.

system registered procedures Internal registered procedures that Open Server supplies for registered procedure notification and status monitoring.

target file In Embedded SQL, one of three files the precompiler can generate. A target file is similar to the original input file, except that all SQL statements are converted to Client-Library function calls.

TDS (Tabular Data Stream) An application-level protocol that Sybase clients and servers use to communicate. It describes commands and results.

thread A path of execution through Open Server application and library code and the path's associated stack space, state information, and event handlers.

Transact-SQL An enhanced version of the database language SQL. Applications can use Transact-SQL to communicate with Adaptive Server Enterprise.

transaction One or more server commands that are treated as a single unit for the purposes of backup and recovery. Commands within a transaction are committed as a group; that is, either all of them are committed or all of them are rolled back.

transaction mode The manner in which Adaptive Server Enterprise manages transactions. Adaptive Server Enterprise supports two transaction modes: Transact-SQL mode (also called "unchained transactions") and ANSI mode (also called "chained transactions").

user name See *login name*.

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