Pervasive.SQL 2000i

SQL Engine Reference

Reference for Using SQL with Pervasive.SQL 2000 Service Pack 3

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About This Manual

This manual contains the reference material you need for understanding the language functionality and limitations of Pervasive.SQL 2000i.

Who Should Read this Manual

This manual provides information for using Pervasive.SQL 2000i.

This manual assumes you have a general understanding of ODBC architecture and ODBC driver components, and have access to the Microsoft ODBC Software Development Kit.

This document also assumes you have a working understanding of modern database principles and terminology, the C language, and your development environment (compiler and linker).

Pervasive Software would appreciate your comments and suggestions about this manual. As a user of our documentation, you are in a unique position to provide ideas that can have a direct impact on future releases of this and other manuals. If you have comments or suggestions for the product documentation, post your request at http://www.pervasive.com/devtalk or send e-mail to docs@pervasive.com.

Manual Organization

This reference includes the following chapters:

- Chapter 1 — “SQL Overview”

  This chapter describes the types of SQL statements you can create using Pervasive.SQL 2000.

- Chapter 2 — “ODBC Engine Reference”

  This chapter describes the Pervasive.SQL 2000 Engine’s capabilities, characteristics, and conformance to the SQL grammar and ODBC API standards.

- Appendix A — “Data Types”

  This appendix contains tables of supported Data Types.

- Appendix B — “SQL Reserved Words”

  This appendix contains the list of supported SQL Keyword.

- Appendix C — “SQL API Mapping to ODBC”

  This appendix contains tables of Scalable SQL and ODBC functions.

- Appendix D — “System Tables”

  This appendix describes the system tables that comprise the relational data dictionary.

The manual also contains an index.

Conventions

Unless otherwise noted, command syntax, code, and examples use the following conventions:

<table>
<tr><td>Case</td><td>Commands and reserved words typically appear in uppercase letters. Unless the manual states otherwise, you can enter these items using uppercase, lowercase, or both. For example, you can type MYPROG, myprog, or MYprog.</td></tr>
<tr><td>[ ]</td><td>Square brackets enclose optional information, as in [log_name]. If information is not enclosed in square brackets, it is required.</td></tr>
<tr><td>|</td><td>A vertical bar indicates a choice of information to enter, as in [file name | @file name].</td></tr>
<tr><td>< ></td><td>Angle brackets enclose multiple choices for a required item, as in <code>/D=<5|6|7></code>.</td></tr>
<tr><td>variable</td><td>Words appearing in italics are variables that you must replace with appropriate values, as in file name.</td></tr>
<tr><td>...</td><td>An ellipsis following information indicates you can repeat the information more than one time, as in [parameter ...].</td></tr>
<tr><td>::=</td><td>The symbol ::= means one item is defined in terms of another. For example, a::=b means the item a is defined in terms of b.</td></tr>
<tr><td>*</td><td>An asterisk is used as a wildcard symbol to indicate a series of APIs with the same prefix.</td></tr>
</table>

Note Unless otherwise noted, all references in this book to the Pervasive.SQL product refer to the current version, Pervasive.SQL 2000i.

For More Information

For complete information on the ODBC 2.5 specification, see the *Microsoft ODBC Programmer's Reference*.

chapter

1

SQL Overview

An Overview of the Structured Query Language (SQL)

Structured Query Language (SQL) is a database language consisting of English-like statements you can use to perform database operations. Both the American National Standards Institute (ANSI) and IBM have defined standards for SQL. (The IBM standard is the Systems Application Architecture [SAA].) The Pervasive.SQL product implements most of the features of both ANSI SQL and IBM SAA SQL and provides additional extensions that neither standard specifies.

Pervasive.SQL allows you to create different types of SQL statements. The following table lists the types of SQL statements you can create and the tasks you can accomplish using each type of statement:

Table 1-1 SQL Statement Types and Related Tasks

SQL Statement Type	Tasks
Data Definition	Create, modify, and delete tables. Create and delete indexes. Create and delete stored SQL procedures. Create and delete triggers.
Data Manipulation	Retrieve, insert, update, and delete data in tables. Define transactions. Define and delete views. Execute stored SQL procedures. Execute triggers.
Data Control	Enable and disable security for a dictionary. Create and delete users and groups. Grant and revoke table access rights.

The rest of this chapter briefly describes the SQL statements used in each statement category. For detailed information about each statement, refer to "ODBC Engine Reference" on page 2-1

The following are the statement category overview sections found in this chapter:

Data Definition Statements

Data definition statements let you specify the characteristics of your database. When you execute data definition statements, Pervasive.SQL stores the description of your database in a data dictionary. You must define your database in the dictionary before you can store or retrieve information.

Pervasive.SQL allows you to construct data definition statements to do the following:

- Create, modify, and delete tables.
- Create and delete indexes.
- Create and delete triggers.
- Create and delete stored procedures.

The following sections briefly describe the SQL statements associated with each of these tasks. For general information about defining the characteristics of your database, refer to the *Pervasive.SQL Programmer's Guide*, available in the Pervasive.SQL Software Developer Kit (SDK).

Creating, Modifying, and Deleting Tables

You can create, modify, and delete tables from a database by constructing statements using the following statements:

Table 1-2 Data Definition Statements - Tables

CREATE TABLE	Defines a table and optionally creates the corresponding data file.
ALTER TABLE	Changes a table definition. With an ALTER TABLE statement, you can perform such actions as add a column to the table definition, remove a column from the table definition, change a column's data type or length (or other characteristics), and add or remove a primary key or a foreign key and associate the table definition with an different data file.
DROP TABLE	Deletes a table from the data dictionary and optionally deletes the associated data file from the disk.

Creating and Deleting Indexes

You can create and delete indexes from a database by constructing statements using the following statements:

Table 1-3 Data Definition Statements - Indexes

CREATE INDEX	Defines a new index (a named index) for an existing table.
DROP INDEX	Deletes a named index.

Creating and Deleting Triggers

You can create and delete triggers from a database by constructing statements using the following statements:

Table 1-4 Data Definition Statements - Triggers

CREATE TRIGGER	Defines a trigger for an existing table.
DROP TRIGGER	Deletes a trigger.

Pervasive.SQL provides additional SQL control statements, which you can only use in the body of a trigger. You can use the following statements in triggers:

Table 1-5 Data Definition Statements - Trigger Control

BEFORE	Defines the trigger execution before the INSERT, UPDATE, or DELETE operation.
AFTER	Defines the trigger execution after the INSERT, UPDATE, or DELETE operation.

Creating and Deleting Stored Procedures

A stored procedure consists of statements you can precompile and save in the dictionary. To create and delete stored procedures, construct statements using the following:

Table 1-6 Data Definition Statements - Stored Procedure

CREATE PROCEDURE	Stores a new procedure in the data dictionary.
DROP PROCEDURE	Deletes a stored procedure from the data dictionary.

Pervasive.SQL provides additional SQL control statements, which you can only use in the body of a stored procedure. You can use the following statements in stored procedures:

Table 1-7 Data Definition Statements - Stored Procedure Control

IF...THEN...ELSE	Provides conditional execution based on the truth value of a condition.
LEAVE	Continues execution by leaving a block or loop statement.
LOOP	Repeats the execution of a block of statements.
WHILE	Repeats the execution of a block of statements while a specified condition is true.

Data Manipulation Statements

Data manipulation statements let you access and modify the contents of your database. Pervasive.SQL allows you to construct data manipulation statements to do the following:

- Retrieve data from tables.
- Modify data in tables.
- Define transactions.
- Create and delete views.
- Execute stored procedures.
- Execute triggers.

The following sections briefly describe the SQL statements associated with each of these tasks.

Retrieving Data

All statements you use to retrieve information from a database are based on the SELECT statement.

Table 1-8 Data Manipulation Statements - Retrieving Data

SELECT	Retrieves data from one or more tables in the database.

When you create a SELECT statement, you can use various clauses to specify different options. (See the entry for the SELECT statement in "ODBC Engine Reference" on page 2-1 for detailed information about each type of clause.) The types of clauses you use in a SELECT statement are as follows:

Table 1-9 Data Manipulation Statements - Retrieving Data Options

FROM	Specifies the tables or views from which to retrieve data.
WHERE	Defines search criteria that qualify the data a SELECT statement retrieves.
GROUP BY	Combines sets of rows according to the criteria you specify and allows you to determine aggregate values for one or more columns in a group.
HAVING	Allows you to limit a view by specifying criteria that the aggregate values of a group must meet.
ORDER BY	Determines the order in which Pervasive.SQL returns selected rows.

In addition, you can use the UNION keyword to obtain a single result table from multiple SELECT queries.

Modifying Data

You can add, change, or delete data from tables and views by issuing statements such as the following:

Table 1-10 Data Manipulation Statements - Modifying Data

INSERT	Adds rows to one or more tables or a view.
UPDATE	Changes data in a table or a view.
DELETE	Deletes rows from a table or a view.

When you create a DELETE or UPDATE statement, you can use a WHERE clause to define search criteria that restrict the data upon which the statement acts.

Defining Transactions

To update the data in a database, you can issue SQL statements individually or you can define *transactions* (logical units of related statements). By defining transactions, you can ensure that either all the statements in a unit of work are executed successfully or none are executed. You can use transactions to group statements to ensure the logical integrity of your database.

Pervasive.SQL supports the ODBC API SQLTransact. See the *Microsoft ODBC Programmer's Reference* for more information.

Creating and Deleting Views

You can create and delete views by constructing statements using the following statements:

Table 1-11 Data Manipulation Statements - Views

CREATE VIEW	Defines a database view and stores the definition in the dictionary.
DROP VIEW	Deletes a view from the data dictionary.

Executing Stored Procedures

A stored procedure consists of statements you can precompile and save in the dictionary. To execute stored procedures, construct statements using the following:

Table 1-12 Data Manipulation Statements- Stored Procedures

CALL	Recalls a previously compiled procedure and executes it.

Executing Triggers

A trigger consists of statements you can precompile and save in the dictionary. Triggers are executed automatically by the engine when the specified conditions occur.

Data Control Statements

Data control statements let you define security for your database. When you create a dictionary, no security is defined for it until you explicitly enable security for that dictionary. Pervasive.SQL allows you to construct data control statements to do the following:

- Enable and disable security.
- Create and delete users and groups.
- Grant and revoke rights.

Note If your Btrieve data files are secured using Btrieve owner names, the Relational Engine will honor them when performing ODBC operations (for example, Read Only access will be permitted with a type 1 or 3 owner name, no access with a type 0 or 2 owner name) if your database is not secured using Relational security. If your database is secured using Relational security, the Relational Engine will enforce access to the database solely based on the defined database user access rights when performing ODBC operations. These rights must be granted with the owner name specified.

The following sections briefly describe the SQL statements associated with each of these tasks.

Enabling and Disabling Security

You can enable or disable security for a database by issuing statements using the following statement:

Table 1-13 Data Control Statements - Security

SET SECURITY	Enables or disables security for the database and sets the Master password.

Creating and Deleting Users and Groups

You can create or delete users and user groups for the database by constructing statements using the following statements:

Table 1-14 Data Control Statements - Groups and Users

CREATE GROUP	Creates a new group of users.
DROP GROUP	Deletes a group of users.
GRANT LOGIN TO	Creates users and passwords, or adds users to groups.
REVOKE LOGIN FROM	Removes a user from the dictionary.

Granting and Revoking Rights

You can assign or remove rights from users or groups by issuing statements using the following:

Table 1-15 Data Control Statements - Rights

GRANT (access rights)	Grants a specific type of rights to a user or a group. The rights you can grant with a GRANT (access rights) statement are All, Insert, Delete, Alter, Select, Update, and References.
GRANT CREATETAB TO	Grants the right to create tables to a user or a group.
REVOKE (access rights)	Revokes access rights from a user or a group.
REVOKE CREATETAB FROM	Revokes the right to create tables from a user or a group.

Database Names

A database name is a name you associate with the location of a dictionary and its data files; it is also the table qualifier. Database names are stored in the database names configuration file (DBNAMES.CFG). If you add a primary key, foreign key, or trigger to a table, the database name is also written to the data file associated with the table. Bound named databases also force the database name to be written to the data file for every table in the database. (For more information about bound databases, refer to the *Pervasive.SQL Programmer's Guide*.)

Database names must follow these conventions:

- Begin with a letter.
- Cannot contain blanks.
- Cannot be a reserved keyword.
- Must not exceed 20 characters.
- Database names are not case-sensitive.

chapter

2

ODBC Engine Reference

A Reference to Pervasive.SQL Supported Syntax

This chapter contains information regarding the limits and conformance of the Pervasive.SQL 2000i ODBC interface:

For detailed information on the ODBC API, SQL grammar, and scalar functions, refer to the *Microsoft ODBC Programmer's Reference*.

Pervasive ODBC Engine Interface Limits

The following limits apply to the Pervasive ODBC Engine Interface:

- Number of rows: 2 billion
- Number of **SELECT** list columns in a query: 1600
- Number of columns in a table: 1536
- Number of columns in a database: the total number of columns, constraints, and indexes in a database must be less than or equal to 65,535. Because a column with the NOT NULL constraint requires an additional field identifier for the constraint itself, the maximum number of NOT NULL columns (assuming no other columns, indexes, or constraints exist) is 32,767.
- Maximum size of a column: 2 GB
- Number of connections: limited by memory
- SQL statement length: 64 KB
- Maximum size of a single term (quoted literal string) in an SQL statement: 14,997, excluding null terminator and quotations (15,000 total)
- Number of statements per connection: limited by memory
- Table name length: 20 characters
- Column name length: 20 characters
- Index name length: 20 characters
- User name length: 30 characters
- Number of columns allowed in a trigger: 300
- Number of arguments in a parameter list for a stored procedure: 300
- Number of joined tables per query: limited by memory
- Length of DBQ entry in the odbc.ini: 20 characters (name of database)
- Maximum of 300 ANDed predicates. For example, this statement uses two ANDed predicates: `SELECT * FROM person WHERE First_Name = 'Janis' AND Last_Name = 'Nipart' AND Perm_Street = '1301 K Street NW.'`
- A character in a character string literal may be any ANSI character between 1 and 255 decimal. A single quote (') must be represented as two consecutive single quotes ('').

Data Source Name Connection String Keywords

A connection string used to connect to a DSN may include any number of driver-defined keywords. Using these keywords, the driver has enough information to connect to the data source. The driver (for example, the Pervasive ODBC Engine Interface or Pervasive ODBC Client Interface) defines which keywords are required to connect to the data source.

Connection strings serve the same purpose in Pervasive.SQL 2000i as they did in previous versions. They are used to identify which data source to connect to. The difference now lies in the driver-defined keywords listed in the connection string. Pervasive.SQL 7 used a different set of keywords to identify a data source.

Listed below are the keywords used in Pervasive.SQL 2000i connection strings.

Table 2-1 Valid Connection Strings for Client DSNs

DSN	Name of the data source as returned by SQLDataSources or the data sources dialog box of SQLDriverConnect.
DRIVER	The description of the driver as returned by SQLDrivers function. For a Client DSN, it is "Pervasive ODBC Client Interface".
ServerName	The address of the server or host name and the port number where the data resides.
ServerDSN	The name of an Engine data source referenced by this DSN.
TransportHint	Specifies the transport protocols to check for the ServerName. The list of transport protocols is specified in the order in which they should be searched.
PWD	The password corresponding to the user ID.
ArrayFetchOn	Enable array fetching. Array fetching is used to improve performance of data fetching between the client and the server. The default setting is to enable array fetching.
ArrayBufferSize	Size of the array buffer. Values between 1 and 64KB are acceptable. The default setting is 8KB.
UID	A user login ID.

Table 2-2 Valid Connection Strings for Engine DSNs

DSN	Name of the data source as returned by SQLDataSources or the data sources dialog box of SQLDriverConnect.
DRIVER	The description of the driver as returned by SQLDrivers function. For an Engine DSN, it is "Pervasive ODBC Engine Interface".
DBQ	A database name.
UID	A user login ID.
PWD	The password corresponding to the user ID.

ODBC API Conformance

The Pervasive ODBC Engine Interface fully conforms to the ODBC v2.5 specifications for core grammar API and Level 1 API, and supports most of the Level 2 function calls. The following table lists the ODBC API functions supported by the Pervasive ODBC Engine Interface and the ODBC Conformance level.

Note The ODBC API functions that are supported in the Pervasive-Oracle Interoperability Environment are described in a separate white paper that is available on the Pervasive home page http://www.pervasive.com

Table 2-3 Interface-supported ODBC API Functions

ODBC Function	ODBC Conformance Level
SQLAllocConnect	Core
SQLAllocEnv	Core
SQLAllocStmt	Core
SQLBindCol	Core
SQLBindParameter	Level 1
SQLBrowseConnect	Level 2
SQLCancel	Core
SQLColAttributes	Core
SQLColumns	Level 1
SQLColumnPrivileges	Level 2
SQLConnect	Core
SQLDataSources	Level 2
SQLDescribeCol	Core
SQLDescribeParam	Level 2
SQLDisconnect	Core

Table 2-3 Interface-supported ODBC API Functions

ODBC Function	ODBC Conformance Level
SQLDriverConnect	Level 1
SQLDrivers	Level 2
SQLError	Core
SQLExecDirect	Core
SQLExecute	Core
SQLExtendedFetch	Level 2
SQLFetch	Core
SQLForeignKeys	Level 2
SQLFreeConnect	Core
SQLFreeEnv	Core
SQLFreeStmt	Core
SQLGetConnectOption	Level 1
SQLGetCursorName	Core
SQLGetData	Level 1
SQLGetFunctions	Level 1
SQLGetInfo	Level 1
SQLGetStmtOption	Level 1
SQLGetTypeInfo	Level 1
SQLMoreResults	Level 2
SQLNativeSql	Level 2
SQLNumResultCols	Core
SQLNumParams	Level 2
SQLParamData	Level 1
SQLPrepare	Core
SQLPrimaryKeys	Level 2

Table 2-3 Interface-supported ODBC API Functions

ODBC Function	ODBC Conformance Level
SQLProcedures	Level 2
SQLProcedureColumns	Level 2
SQLPutData	Level 1
SQLRowCount	Core
SQLSetConnectOption	Level 1
SQLSetCursorName	Core
SQLSetPos	Level 2
SQLSetStmtOption	Level 1
SQLSpecialColumns	Level 1
SQLStatistics	Level 1
SQLTables	Level 1
SQLTablePrivileges	Level 2
SQLTransact	Core

Exceptions to ODBC API Conformance

The following section contains details on the exceptions to ODBC API conformance as specified in Table 2-3 on page 2-5.

SQLMoreResults

The Pervasive ODBC Engine Interface always returns `SQL_NO_DATA_FOUND` for this function. The Pervasive ODBC Engine Interface supports this function, with its return value, due to requirements of Microsoft Access.

SQLSetStmtOption / SQLGetStmtOption

The following table lists the options the Pervasive ODBC Engine Interface supports for SQLSetStmtOption and SQLGetStmtOption:

Table 2-4 Options for SQLSetStmtOption and SQLGetStmtOption

fOption (numerical value)	vParam	Comments
SQL_MAX_ROWS(1)		Supported according to the *Microsoft ODBC Programmer's Reference*.
SQL_NOSCAN(2)		Supported according to the *Microsoft ODBC Programmer's Reference*
SQL_MAX_LENGTH(3)		Supported according to the *Microsoft ODBC Programmer's Reference*
SQL_ASYNC_ENABLE(4)		Supported according to the *Microsoft ODBC Programmer's Reference*
SQL_CURSOR_TYPE(6)		Supported according to the *Microsoft ODBC Programmer's Reference*
SQL_CONCURRENCY(7)		Supported according to the *Microsoft ODBC Programmer's Reference*
SQL_ROWSET_SIZE(9)		Supported according to the *Microsoft ODBC Programmer's Reference*

Table 2-4 Options for SQLSetStmtOption and SQLGetStmtOption

fOption (numerical value)	vParam	Comments
1151	in the format: Tablename,Password (no space between the Tablename and the Password)	A Pervasive ODBC Engine Interface extension: appends password for table to an internal list in Pervasive ODBC Engine Interface so that the user does not have to be prompted for the password.
1153	0 (default) turns off table locking; 1 turns on table locking.	A Pervasive ODBC Engine Interface extension: When vParam is set to 1, all tables used by the hStmt are exclusively locked when a select, update, insert, delete, or create index statement is executed on the hStmt. The tables remain locked until the hStmt is dropped (by calling SQLFreeStmt with the SQL_DROP option) or the option is set to DEFLOCK and the hStmt is re-executed. Locked tables can only be used by the locking hStmt; they cannot be used by any other hStmts.

SQLSetConnectOption and SQLGetConnectOption

The following table lists the options the Pervasive ODBC Engine Interface supports for SQLSetConnectOption and SQLGetConnectOption:

Table 2-5 Options for SQLSetConnectOption and SQLGetConnectOption

fOption (numerical value)	Comments
SQL_ACCESS_MODE(101)	Supported according to the *Microsoft ODBC Programmer's Reference*.
SQL_AUTO(102)	Supported according to the *Microsoft ODBC Programmer's Reference*.

SQLGetTypeInfo

SQLGetTypeInfo generates a list of native data type names (type_name) specified by the Pervasive ODBC Engine Interface. For example, `SQL_CHAR` is mapped to `CHARACTER`. Use the names which are returned from this function for the data type names for columns in a **CREATE TABLE** or **ALTER TABLE** statement or for parameters for procedures or declared variables in procedures and triggers.

SQLSpecialColumns

The Pervasive ODBC Engine Interface uses unique indexes as the optimal set of columns that uniquely identifies a row in the table. When a new row is inserted, the Pervasive ODBC Engine Interface does not return the values for autoincrement columns.

SQL Grammar Conformance

The ODBC v2.5 specification provides three levels of SQL grammar conformance: Minimum, Core, and Extended. Each higher level provides more fully-implemented data definition and data manipulation language support. The Pervasive ODBC Engine Interface fully supports the minimum SQL grammar, as well as many core and extended grammar statements. The Pervasive ODBC Engine Interface support for SQL grammar is summarized in the following table.

Table 2-6 SQL Grammar Conformance

SQL Grammar Statement	Minimum	Core	Extended
ALTER TABLE			✔
CREATE GROUP			✔
CREATE INDEX		✔	
CREATE PROCEDURE			✔
CREATE TABLE			✔
CREATE TRIGGER			✔
CREATE VIEW		✔	
DELETE (positional)	✔		
DELETE (searched)	✔		
DROP GROUP			✔
DROP INDEX		✔	
DROP PROCEDURE			✔
DROP TABLE	✔		
DROP TRIGGER			✔
DROP VIEW		✔	

Table 2-6 SQL Grammar Conformance

SQL Grammar Statement	Minimum	Core	Extended
GRANT		✔	
INSERT	✔		
JOIN LEFT OUTER (Select)			✔
REVOKE		✔	
SELECT (with into)	✔		
- approximate-numeric-literal		✔	
- between-predicate		✔	
- correlation-name		✔	
- date arithmetic			✔
- date-literal			✔
- exact-numeric-literal		✔	
- extended predicates			✔
- in-predicate		✔	
- set-function		✔	
- time-literal			✔
- timestamp-literal			✔
Subqueries		✔	
UNION			✔
SET SECURITY			✔
UPDATE (positional)	✔		
UPDATE (searched)	✔		

Delimited Identifiers in SQL Statements

Column names and table names can occur as delimited identifiers if they contain non-ODBC standard characters. The delimiter character for delimited identifiers is a double-quote. For example:

```
SELECT "last-name" FROM "non-standard-tbl"
```

Global Variables

Pervasive.SQL 2000i supports the following global variables:

- @@IDENTITY
- @@ROWCOUNT

Either variable can be prefaced with two at signs (@@) or an at sign and a colon (@:). For example, @@IDENTITY and @:IDENTITY are equivalent.

@@IDENTITY and @@ROWCOUNT are global variables *per connection*. Each database connection has its own @@IDENTITY and @@ROWCOUNT values.

@@IDENTITY

This variable returns the value of the most recently inserted IDENTITY column value (IDENTITY or SMALLIDENTITY). The value is a signed integer value. The initial value is NULL.

This variable can only refer to a single column. If the target table includes more than one IDENTITY column, the value of this variable refers to the IDENTITY column that is the table's primary key. If no such column exists, then the value of this variable refers to the first IDENTITY column in the table.

If the most recent insert was to a table without an IDENTITY column, then the value of @@IDENTITY is set to NULL.

Examples

```
SELECT @@IDENTITY
```

Returns NULL if no records have been inserted in the current connection, otherwise returns the IDENTITY column value of the most recently inserted row.

```
SELECT * FROM T1 WHERE @:IDENTITY = 12
```

Returns the most recently inserted row if it has an IDENTITY column value of 12. Otherwise, returns no rows.

```
INSERT INTO T1(C2) VALUES (@@IDENTITY)
```

Inserts the IDENTITY value of the last row inserted into column C2 of the new row.

```
UPDATE T1 SET T1.C1 = (SELECT @@IDENTITY) WHERE T1.C1 =
@@IDENTITY + 10
```

Updates column C1 with the IDENTITY value of the last row inserted, if the value of C1 is 10 greater than the IDENTITY column value of the last row inserted.

```
UPDATE T1 SET T1.C1 = (SELECT NULL FROM T2 WHERE T2.C1 =
@@IDENTITY)
```

Updates column C1 with the value NULL if the value of C1 equals the IDENTITY column value of the last row inserted.

The example below creates a stored procedure and calls it. The procedure sets variable V1 equal to the sum of the input value and the IDENTITY column value of the last row updated. The procedure then deletes rows from the table anywhere column C1 equals V1. The procedure then prints a message stating how many rows were deleted.

```
CREATE PROCEDURE TEST (IN :P1 INTEGER);
   BEGIN
   DECLARE :V1 INTERGER;
      SET :V1 = :P1 + @@IDENTITY;
      DELETE FROM T1 WHERE T1.C1 = :V1;
      IF (@@ROWCOUNT = 0) THEN
      PRINT 'No row deleted';
      ELSE
      PRINT CONVERT(@@ROWCOUNT, SQL_CHAR) +
      ' rows deleted';
      END IF;
   END;
CALL TEST (@@IDENTITY)
```

@@ROWCOUNT

This variable returns the number of rows that were affected by the most recent operation in the current connection. The value is an unsigned integer. The initial value is zero.

Grammar

Same as the grammar for @@IDENTITY.

Examples

```
SELECT @@ROWCOUNT
```

Returns zero if no records were affected by the previous operation in the current connection, otherwise returns the number of rows affected by the previous operation.

```
CREATE TABLE T1 (C1 INTEGER, C2 INTEGER)
   INSERT INTO T1 (C1, C2) VALUES (100,200)
   INSERT INTO T1(C2) VALUES (100, @@ROWCOUNT)
   SELECT * FROM T1
SELECT @@ROWCOUNT FROM T1
```

Results:

```
C1     C2
----   ----
100    200
100    1

2
```

The first **SELECT** generates two rows and shows that the value of @@ROWCOUNT was 1 when it was used to insert a row. The second **SELECT** returns 2 as the value of @@ROWCOUNT, that is, after the first **SELECT** returned two rows.

Also see the example for @@IDENTITY.

SQL Grammar Elements

The following pages in this section describe the complete grammar for all supported SQL grammar elements.

Note You can use the SQL Data Manager provided with the Pervasive Control Center to test most of the SQL examples. Exceptions are noted in the discussion of the grammar elements. Type the SQL statements directly in the query pane. If you wish to enter more than one SQL statement, separate each statement using the pound sign (#). You can change this delimiter character to a semi-colon by selecting **Tools | Properties** from the menu.

ADD

Remarks

Use the **ADD** clause within the **ALTER TABLE** statement to specify one or more column definitions, column constraints, or table constraints to be added.

See Also

"ALTER TABLE" on page 2-19

ALL

Remarks

When you specify the **ALL** keyword before a subquery, Pervasive.SQL 2000i performs the subquery and uses the result to evaluate the condition in the outer query. If all the rows the subquery returns meet the outer query's condition for a particular row, Pervasive.SQL 2000i includes that row in the final result table of the statement.

Generally, you can use the **EXISTS** or **NOT EXISTS** keyword instead of the **ALL** keyword.

Examples

The following **SELECT** statement compares the ID column from the Person table to the ID columns in the result table of the subquery:

```
SELECT p.ID, p.Last_Name
   FROM Person p
      WHERE p.ID <> ALL
      SELECT f.ID FROM Faculty f WHERE f.Dept_Name =
         'Chemistry');
```

If the ID value from Person does not equal to any of the ID values in the subquery result table, Pervasive.SQL includes the row from Person in the final result table of the statement.

See Also

"GRANT" on page 2-80

"SELECT (with into)" on page 2-117

"SELECT" on page 2-118

"UNION" on page 2-136

ALTER TABLE

The **ALTER TABLE** statement modifies a table definition.

Syntax

ALTER TABLE *table-name* [**IN DICTIONARY**]
  [**USING** '*path_name*'] [**WITH REPLACE**] *alter-option-list*

table-name ::=user-defined-name

alter-option-list ::=*alter-option*

  | (*alter-option* [, *alter-option*} . . .)

alter-option ::= **ADD** [**COLUMN**] *column-definition*

  | **ADD** *table-constraint-definition*

  | **DROP** [**COLUMN**] *column-name*

  | **DROP CONSTRAINT** *constraint-name*

  | **DROP PRIMARY KEY**

  | **MODIFY [COLUMN]** *column-definition*

  | **ALTER [COLUMN]** *column-definition*

column-definition ::= *column-name data-type* [**DEFAULT** *default-value*] [
  column-constraint [*column-constraint*] . . . [**CASE** | **COLLATE**
  collation-name]

column-name ::= *user-defined-name*

data-type ::= *data-type-name* [(*precision* [, *scale*])]

precision ::= integer

scale ::= integer

default-value ::= *literal*

literal ::= 'string'

  | number

  | { d 'date-literal' }

  | { t 'time-literal' }

  | { ts 'timestamp-literal' }

column-constraint ::= [**CONSTRAINT** *constraint-name*] *col-constraint*

constraint-name ::= *user-defined-name*

```
col-constraint ::= NOT NULL
    | UNIQUE
    | PRIMARY KEY
    | REFERENCES table-name [ ( column-name ) ] [ referential-actions ]

referential-actions ::= referential-update-action [ referential-delete-action ]
    | referential-delete-action [ referential-update-action ]

referential-update-action ::= ON UPDATE RESTRICT

referential-delete-action ::= ON DELETE CASCADE
    | ON DELETE RESTRICT

collation-name ::= 'string' | user-defined-name

table-constraint-definition ::= [ CONSTRAINT constraint-name ] table-
    constraint

table-constraint ::= UNIQUE (column-name [ , column-name ]... )
    | PRIMARY KEY ( column-name [ , column-name ]... )
    | FOREIGN KEY ( column-name [ , column-name ] )
    REFERENCES table-name
    [ ( column-name [ , column-name ]... ) ]
    [ referential-actions ]
```

Remarks

Refer to CREATE TABLE for information pertaining to primary and foreign keys and referential integrity.

IN DICTIONARY

The purpose of using this keyword is to notify the SQL Relational Database Engine (SRDE) that you wish to make modifications to the DDFs, while leaving the underlying physical data unchanged. IN DICTIONARY is a very powerful and advanced feature. It should only be used by system administrators or when absolutely necessary. Normally, the SRDE keeps DDFs and data files totally synchronized, but this feature allows users the flexibility to force table dictionary definitions to match an existing data file. This can be useful when you want to create a definition in the dictionary to match an existing data file, or when you want to use a USING clause to change the data file path name for a table.

You cannot use this keyword on a bound database.

IN DICTIONARY is allowed on **CREATE** and **DROP TABLE**, in addition to **ALTER TABLE**. IN DICTIONARY affects dictionary entries *only*, no matter what CREATE/ALTER options are specified. Since Pervasive.SQL 2000i allows multiple options (any combination of ADD, DROP, ADD CONSTRAINT, and so on), IN DICTIONARY is honored under all circumstances to guarantee only the DDFs are affected by the schema changes.

Tables that exist in the DDFs only (the data file does not exist) are called *detached* entries. These tables are inaccessible via queries or other operations that attempt to open the physical underlying file. For this reason, IN DICTIONARY was added to **DROP TABLE**, because it is now possible to create detached entries using **CREATE TABLE**. Note that errors such as "Table not found" are generated by attempts to access these detached entries. One can verify whether a table really exists by using SQLTables or directly querying the Xf$Name column of X$File:

```
SELECT * FROM X$File WHERE Xf$Name = 'table_name'
```

It is possible for a detached table to cause confusion, so the IN DICTIONARY feature must be used with extreme care. It is crucial that it should be used to force table definitions to match physical files, not to detach them. Consider the following examples, assuming that the file test123.btr does not exist. (USING is explained below, in the next subtopic.)

```
CREATE TABLE t1 USING 't1.btr' (c1 INT)
ALTER TABLE t1 IN DICTIONARY USING 'test123.btr'
```

Or, combining both statements:

```
CREATE TABLE t1 IN DICTIONARY USING 'test123.btr' (c1
INT)
```

If you then attempt to **SELECT** from t1, you receive an error that the table was not found. Confusion can arise, because you just created the table—how can it not be found? Likewise, if you attempt to DROP the table without specifying IN DICTIONARY, you receive the same error. These errors are generated because there is no data file associated with the table.

USING

The USING keyword allows you to associate a **CREATE TABLE** or **ALTER TABLE** action with a particular data file.

Because Pervasive.SQL requires a Named Database to connect, the *path_name* provided must always be a simple file name or relative path and file name. Paths are always relative to the first Data Path specified for the Named Database to which you are connected.

The path/file name passed is partially validated when SQLPrepare is called. The following rules must be followed when specifying the path name:

- The text must be enclosed in single quotes, as shown in the grammar definition.
- Text must be 1 to 64 characters in length, such that the entry as specified fits in Xf$Loc in X$File. The entry is stored in Xf$Loc exactly as typed (trailing spaces are truncated and ignored).
- The path must be a simple, relative path. Paths that reference a server or volume are not allowed. For NetWare, a volume-based path (such as SYS:/path/testfile.btr) is ***not*** considered a simple, relative path.
- Relative paths containing a period ('.' - current directory) , double-period ('..' - parent directory), slash '\', or any combination of the three are allowed. The path must contain a file name representing the SQL table name (*path_name* cannot end in a slash '\' or a directory name). All file names, including those specified with relative paths, are relative to the first Data Path as defined in the Named Database configuration.
- Root-based relative paths are also allowed. For example, assuming that the first data path is D:\PVSW\DEMODATA, the SRDE interprets the path name in the following statement as D:\TEMP\TEST123.BTR.

  ```
  CREATE TABLE t1 USING '\temp\test123.btr' (c1 int)
  ```
- Slash ('\') characters in relative paths may be specified either UNIX style ('/') or in the customary backslash notation ('\'), depending on your preference. You may use a mixture of the two types, if desired. This is a convenience feature since you may know the directory structure scheme, but not necessarily know (or care) what type of server you are connected to. The path is stored in X$File exactly as typed. The SRDE engine converts the slash characters to the appropriate platform type when utilizing

the path to open the file. Also, since data files share binary compatibility between all supported platforms, this means that as long as the directory structure is the same between platforms (and path-based file names are specified as relative paths), the database files and DDFs can be moved from one platform to another with no modifications. This makes for a much simpler cross-platform deployment with a standardized database schema.

- If specifying a relative path, the directory structure in the USING clause must first exist. The SRDE does not create directories to satisfy the path specified in the USING clause.

Include a USING clause to specify the physical location and name of an existing data file to associate with an existing table. A USING clause also allows you to create a new data file at a particular location using an existing dictionary definition. (The string supplied in the USING clause is stored in the Xf$Loc column of the dictionary file X$File.) The original data file must be available when you create the new file since some of the file information must be obtained from the original.

In the DEMODATA sample database, the Person table is associated with the file PERSON.MKD. If you create a new file named PERSON2.MKD, the statement in the following example changes the dictionary definition of the Person table so that the table is associated with the new file.

```
ALTER TABLE Person IN DICTIONARY USING 'person2.mkd'
```

You must use either a simple file name or a relative path in the USING clause. If you specify a relative path, Pervasive.SQL interprets it relative to the first data file path associated with the database name.

The USING clause can be specified in addition to any other standard **ALTER TABLE** option. This means columns can be manipulated in the same statement that specifies the USING path.

If you specify a data file name that differs from the data file name currently used to store the table data, the SRDE creates the new file and copies all of the data from the existing file into the new file. For example, suppose person.mkd is the current data file that holds the data for table Person. You then alter table Person using data file person2.mkd, as shown in the statement above. The contents of `person.mkd` are copied into person2.mkd. Person2.mkd then becomes the data file associated with table Person and database operations affect person2.mkd. Person.mkd is not deleted, but it is not associated with the database any more.

The reason for copying the data is because Pervasive.SQL allows all other **ALTER TABLE** options at the same time as USING. The new data file created needs to be fully populated with the existing table's data. The file structure is not simply copied, but instead the entire contents are moved over, similar to a Btrieve BUTIL -CREATE and BUTIL -COPY. This can be helpful for rebuilding an SQL table, or compressing a file that once contained a large number of records but now contains only a few.

Note ALTER TABLE USING copies the contents of the existing data file into the newly specified data file, leaving the old data file intact but unlinked.

WITH REPLACE

Whenever WITH REPLACE is specified with the USING keyword, Pervasive.SQL automatically overwrites any existing file name with the specified file name. The existing file is always overwritten as long as the operating system allows it.

WITH REPLACE affects only the data file, it never affects the DDFs.

The following rules apply when using WITH REPLACE:

- WITH REPLACE can only be used with USING.
- When used with IN DICTIONARY, WITH REPLACE is ignored because IN DICTIONARY specifies that only the DDFs are affected.

Note No data is lost or discarded if WITH REPLACE is used with **ALTER TABLE**. The newly created data file, even if overwriting an existing file, still contains all data from the previous file. You cannot lose data by issuing an **ALTER TABLE** command.

Include WITH REPLACE in a USING clause to instruct Pervasive.SQL to replace an existing file (the file must reside at the location you specified in the USING clause). If you include WITH REPLACE, Pervasive.SQL creates a new file and copies all the data from the existing file into it. If you do not include WITH REPLACE and a file exists at the specified location, Pervasive.SQL returns a status code and does not create the new file. The status code is SRDE error -4940, Btrieve error 59.

MODIFY COLUMN and ALTER COLUMN

The ability to modify the nullability or data type of a column is subject to the following restrictions:

- The target column cannot have a PRIMARY/FOREIGN KEY constraint defined on it.
- If converting the old type to the new type causes an overflow (arithmetic or size), the ALTER TABLE operation is aborted.
- If a nullable column contains NULL values, the column cannot be changed to a non-nullable column.

If you must change the data type of a key column, you can do so by dropping the key, changing the data type, and re-adding the key. Keep in mind that you must ensure that all associated key columns remain synchronized. For example, if you have a primary key in table T1 that is referenced by foreign keys in tables T2 and T3, you must first drop the foreign keys. Then you can drop the primary key. Then you need to change all three columns to the same data type. Finally, you must re-add the primary key and then the foreign keys.

The ANSI standard includes the **ALTER** keyword. Pervasive.SQL allows both keywords (**ALTER** and **MODIFY**) in the **ALTER TABLE** statement:

```
ALTER TABLE T1 MODIFY C1 INTEGER
ALTER TABLE T1 ALTER C1 INTEGER
ALTER TABLE T1 MODIFY COLUMN C1 INTEGER
ALTER TABLE T1 ALTER COLUMN C1 INTEGER
```

Pervasive.SQL allows altering a column to a smaller length if the actual data does not overflow the new, smaller length of the column. This behavior is similar to that of Microsoft SQL Server.

You can add, drop, or modify multiple columns on a single **ALTER TABLE** statement. Although it simplifies operations, this behavior is not considered ANSI-compliant. The following is a sample multi-column **ALTER** statement.

```
ALTER TABLE T1 (ALTER C2 INT, ADD D1 CHAR(20), DROP C4,
ALTER C5 LONGVARCHAR, ADD D2 LONGVARCHAR NOT NULL)
```

You can convert all legacy data types (Pervasive.SQL v7 or earlier) to data types that are natively supported by Pervasive.SQL 2000i. But the new data types cannot be converted backwards to legacy data types.

To add a LONGVARCHAR/LONGVARBINARY column to a legacy table that contains a NOTE/LVAR column, the NOTE/LVAR column first has to be converted to a LONGVARCHAR or LONGVARBINARY column. After converting the NOTE/LVAR column to LONGVARCHAR/LONGVARBINARY, you can add more LONGVARCHAR/LONGVARBINARY columns to the table. Note that the legacy engine does not work with this legacy table because the legacy engine can work with only one variable length column per table.

Examples

The following statement adds the Emergency_Phone column to the Person table

```
ALTER TABLE person ADD Emergency_Phone NUMERIC(10,0)
```

The following statement adds two integer columns col1 and col2 to the Class table.

```
ALTER TABLE class(ADD col1 INT, ADD col2 INT)
```

▼▼▼

To drop a column from a table definition, specify the name of the column in a **DROP** clause. The following statement drops the emergency phone column from the Person table.

```
ALTER TABLE person DROP Emergency_Phone
```

The following statement drops col1 and col2 from the Class table.

```
ALTER TABLE class(DROP col1, DROP col2)
```

The following statement drops the constraint c1 in the Faculty table.

```
ALTER TABLE Faculty(DROP CONSTRAINT c1)
```

▼▼▼

This example adds an integer column col3 and drops column col2 to the Class table

```
ALTER TABLE class(ADD col3 INT, DROP col2 )
```

▼▼▼

The following example creates a primary key named c1 on the ID field in the Faculty table. Note that you cannot create a primary key on a Nullable column. Doing so generates the error, "Nullable columns are not allowed in primary keys".

```
ALTER TABLE Faculty(ADD CONSTRAINT c1 PRIMARY KEY(ID))
```

The following example creates a primary key PK_ID in the Faculty table.

```
ALTER TABLE Faculty(ADD PRIMARY KEY(ID))
```

▾ ▾ ▾

The following example adds the constraint **UNIQUE** to the columns col1 and col2.

```
ALTER TABLE Class(ADD UNIQUE(col1,col2))
```

▾ ▾ ▾

The following example drops the primary key in the Faculty table. Because a table can have only one primary key, you cannot add a primary key to a table that already has a primary key defined. To change the primary key of a table, delete the existing key then add the new primary key.

```
ALTER TABLE Faculty(DROP PRIMARY KEY)
```

Before you can drop a primary key from a parent table, you must drop any corresponding foreign keys from dependent tables.

▾ ▾ ▾

The following example adds a new foreign key to the Class table. The Faculty column is defined as an index that does not include NULL values. You cannot create a foreign key on a Nullable column.

```
ALTER TABLE Class ADD CONSTRAINT Teacher FOREIGN KEY
(Faculty_ID) REFERENCES Faculty (ID) ON DELETE RESTRICT
```

In this example, the restrict rule for deletions prevents someone from removing a faculty member from the database without first either changing or deleting all of that faculty's classes.

If you add a foreign key to a table that already contains data, use the Referential Integrity (RI) test to find any data that does not conform to the new referential constraint. The RI test is run from the Check Database wizard in the Pervasive Control Center (PCC).

The following statement shows how to drop the foreign key added in this example. Pervasive.SQL drops the foreign key from the dependent table and eliminates the referential constraints between the dependent table and the parent table.

```
ALTER TABLE Class DROP CONSTRAINT Teacher
```

The following example adds a foreign key to the Class table without using the CONSTRAINT clause.

```
ALTER TABLE Class ADD FOREIGN KEY (Faculty_ID)
REFERENCES Faculty (ID) ON DELETE RESTRICT
```

This creates foreign key FK_Faculty_ID. To drop the foreign key, specify the CONSTRAINT keyword:

```
ALTER TABLE Class DROP CONSTRAINT FK_Faculty_ID
```

The following example illustrates multiple adding and dropping of constraints and columns in a table. This statement drops column salary, adds a column col1 of type integer, and drops constraint c1 in the Faculty table.

```
ALTER TABLE Faculty(DROP salary, ADD col1 INT, DROP
CONSTRAINT c1)
```

The following examples illustrate altering the data type of multiple columns.

```
ALTER TABLE T1 (ALTER C2 INT, ADD D1 CHAR(20), DROP C4,
ALTER C5 LONGVARCHAR, ADD D2 LONGVARCHAR NOT NULL)
```

```
ALTER TABLE T2 (ALTER C1 CHAR(50), DROP CONSTRAINT
MY_KEY, DROP PRIMARY KEY, ADD MYCOLUMN INT)
```

The following examples illustrate how the column default and alternate collating sequence can be set or dropped with the ALTER or MODIFY column options.

```
CREATE TABLE T1 (c1 INT DEFAULT 10, c2 CHAR(10))
```

```
ALTER TABLE T1 ALTER c1 INT DEFAULT 20
```
— resets column c1 default to 20

```
ALTER TABLE T1 ALTER c1 INT
```
— drops column c1 default

```
ALTER TABLE T1 ALTER c2 CHAR(10)
COLLATE 'c:\pvsw\samples\upper.alt'
```
— sets alternate collating sequence on column c2

```
ALTER TABLE T1 ALTER c2 CHAR(10)
```
— drops alternate collating sequence on column c2

Upper.alt treats upper and lower case letters the same for sorting. For example, if a database has values abc, ABC, DEF, and Def, inserted in that ordered, the sorting with upper.alt returns as abc, ABC, DEF, and Def. (The values abc and ABC, and the values DEF and Def are considered duplicates and are returned in the order in which they were inserted.) Normal ASCII sorting sequences upper case letters before lower case, such that the sorting would return as ABC, DEF, Def, abc.

ANY

Remarks

The **ANY** keyword works similarly to the **ALL** keyword except that Pervasive.SQL 2000i includes the compared row in the result table if the condition is true for any row in the subquery result table.

Examples

The following statement compares the ID column from Person to the ID columns in the result table of the subquery. If the ID value from Person is equal to any of the ID values in the subquery result table, Pervasive.SQL includes the row from Person in the result table of the **SELECT** statement.

```
SELECT p.ID, p.Last_Name
   FROM Person p
      WHERE p.ID = ANY
      (SELECT f.ID FROM Faculty f WHERE f.Dept_Name =
         'Chemistry');
```

See Also

"SELECT" on page 2-118

AS

Remarks

Include an **AS** clause to assign a name to a select term or to a table name. You can use this name elsewhere in the statement to reference the select term. When you use the **AS** clause on a non-aggregate column, you can reference the name in **WHERE**, **ORDER BY**, **GROUP BY**, and **HAVING** clauses. When you use the **AS** clause on an aggregate column, you can reference the name only in an **ORDER BY** clause.

The name you define must be unique in the **SELECT** list.

Examples

The **AS** clause in the following statement instructs Pervasive.SQL to assign the name Total to the select term SUM (Amount_Paid) and order the results by the total for each student:

```
SELECT Student_ID, SUM (Amount_Paid) AS Total
   FROM Billing
      GROUP BY Student_ID
ORDER BY Total
```

When you use the **AS** clause on a table name in a **FROM** clause, you can reference the name in a **WHERE**, **ORDER BY**, **GROUP BY**, and **HAVING** clause.

```
SELECT DISTINCT c.Name, p.First_Name, c.Faculty_Id
   FROM Person AS p, class AS c
      WHERE p.Id = c.Faculty_Id
ORDER BY c.Faculty_Id
```

You can rewrite this query without using the **AS** clause in the **FROM** clause as follows.

```
SELECT DISTINCT c.Name, p.First_Name, c.Faculty_Id
   FROM Person p, class c
      WHERE p.Id = c.Faculty_Id
ORDER BY c.Faculty_Id
```

See Also

"SELECT" on page 2-118

BEGIN [ATOMIC]

Remarks

It is often convenient to group individual statements so that they can be treated as a single unit. The **BEGIN** and **END** statements are used in compound statements to group the statements into a unit. You can use a compound statement only in the body of a stored procedure or in a trigger declaration.

ATOMIC specifies that the set of statements within the unit either all succeed or all fail. If one condition within the **BEGIN ATOMIC . . . END** unit is not met, no records are affected. If the condition should affect more than one row, all rows (or none) are affected. For any record to be affected, all the conditions within a **BEGIN ATOMIC . . . END** unit must return true.

Examples

In the following example, two UPDATEs are grouped as an ATOMIC unit. The Perm_State column in the Person table is updated only if all of the other conditions are true. That is, a record for Bill Andrew exists with 'TX' as the Perm_State, and a record for Yvette Lopez exists with 'OR' as the Perm_State. If any of these conditions are not true, neither record is updated. Assume the **BEGIN . . . END** unit is within a procedure.

```
BEGIN ATOMIC
    UPDATE Person SET Perm_State = 'MA' WHERE Perm_State
        = 'TX' AND First_Name = 'Bill' AND Last_Name =
        'Andrew';
    UPDATE Person SET Perm_State = 'WA' WHERE Perm_State
        = 'OR' AND First_Name = 'Yvette' AND Last_Name =
        'Lopez';
END;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

CALL

Remarks

Use the **CALL** statement to invoke a previously created stored procedure.

Examples

The following example calls a procedure without parameters:

`CALL NoParms()` or `CALL NoParms`

The following examples call a procedure with parameters:

```
CALL Parms(vParm1, vParm2)
```

```
CALL CheckMax(N.Class_ID)
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

CASCADE

Remarks

If you specify **CASCADE** when creating a Foreign Key, Pervasive.SQL uses the **DELETE CASCADE** rule. When a user deletes a row in the parent table, Pervasive.SQL 2000i deletes the corresponding rows in the dependent table.

See Also

"ALTER TABLE" on page 2-19

"CREATE TABLE" on page 2-50

CASE

Remarks

The **CASE** keyword causes Pervasive.SQL to ignore case when evaluating restriction clauses involving a string column.

For example, suppose if you have a column called Name that is defined with the **CASE** attribute. If you insert two rows with Name = ‘Smith’ and Name = ‘SMITH,’ a query with a restriction specifying Name = ‘smith’ correctly returns both rows.

Examples

The following example shows how you add a column to the Student table with the **CASE** keyword.

```
ALTER TABLE Student ADD Name char(64) CASE
```

The following example shows how to modify a column with the **CASE** keyword.

```
ALTER TABLE Student MODIFY Name char(64) CASE
```

See Also

“ALTER TABLE” on page 2-19

“SELECT” on page 2-118

CLOSE

Remarks

The **CLOSE** statement closes an open SQL cursor.

The cursor that the cursor name specifies must be open.

This statement is allowed only inside of a stored procedure or a trigger, since cursors and variables are only allowed inside of stored procedures and triggers.

Examples

The following example closes the cursor BTUCursor.

```
CLOSE BTUCursor;
```

See Also

"OPEN" on page 2-104

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

COMMIT

The **COMMIT** statement signals the end of a logical transaction and converts temporary data into permanent data. The logical transaction begins with **START TRANSACTION. COMMIT** must always be paired with **START TRANSACTION. START TRANSACTION** must always be paired with a **COMMIT** or a **ROLLBACK**.

Syntax

```
COMMIT [WORK]
```

Remarks

COMMIT (and **START TRANSACTION**) is supported only within stored procedures. You cannot use **COMMIT** or **START TRANSACTION** within the SQL Data Manager. (The SQL Data Manager sets AUTOCOMMIT to "on.")

Any committed statements within a stored procedure are controlled by the outermost transaction of the calling ODBC application. This means that, depending on the AUTOCOMMIT mode specified on SQLSetConnectOption, calling the stored procedure externally from an ODBC application performs one of two actions. It either commits automatically (AUTOCOMMIT on, the default) or waits for you to call SQLTransact with SQL_COMMIT or SQL_ROLLBACK (when AUTOCOMMIT is set to off).

You may call multiple **START TRANSACTION** statements to start the nested transactions, but the outermost **COMMIT** controls whether any nested committed blocks are committed or rolled back. For example, if transactions are nested five levels, then five **COMMIT** statements are needed to commit all of the transactions. **COMMIT** does not release any lock until the outermost transaction is committed.

COMMIT and **COMMIT WORK** perform the same functionality.

Examples

The following example, within a stored procedure, begins a transaction which updates the Amount_Owed column in the Billing table. This work is committed; another transaction updates the Amount_Paid column and sets it to zero. The final **COMMIT WORK** statement ends the second transaction.

Statements are delimited with a semi-colon inside stored procedures and triggers.

```
START TRANSACTION;
UPDATE Billing B
    SET Amount_Owed = Amount_Owed - Amount_Paid
    WHERE Student_ID IN
        (SELECT DISTINCT E.Student_ID
        FROM Enrolls E, Billing B
        WHERE E.Student_ID = B.Student_ID);
COMMIT WORK;
START TRANSACTION;
UPDATE Billing B
    SET Amount_Paid = 0
    WHERE Student_ID IN
        (SELECT DISTINCT E.Student_ID
        FROM Enrolls E, Billing B
        WHERE E.Student_ID = B.Student_ID);
COMMIT WORK;
```

See Also

"CREATE PROCEDURE" on page 2-42

"ROLLBACK" on page 2-114

"START TRANSACTION" on page 2-134

CREATE GROUP

The **CREATE GROUP** statement creates one or more security groups.

Syntax

CREATE GROUP *group-name* [, *group-name*] . . .

group-name ::= *user-defined-name*

Examples

The following example creates a group named pervasive.

```
CREATE GROUP pervasive
```

The next example uses a list to create several groups at once.

```
CREATE GROUP pervasive_dev, pervasive_marketing
```

See Also

"DROP GROUP" on page 2-69

"GRANT" on page 2-80

"REVOKE" on page 2-112

"SET SECURITY" on page 2-129

CREATE INDEX

Use the **CREATE INDEX** statement to create a named index for a specified table.

Syntax

CREATE [**UNIQUE** | **NOT MODIFIABLE**] **INDEX** *index-name*
    ON *table-name* [*index-definition*]

index-definition ::= (*index-segment-definition* [, *index-segment-definition*
    ] . . .)

index-segment-definition ::= *column-name* [**ASC** | **DESC**]

index-name ::= *user-defined-name*

Remarks

The maximum column size for varchar columns is 254 bytes if the column does not allow Null values and 253 bytes if the column is nullable.

The maximum column size for char columns is 255 bytes if the column does not allow Null values and 254 bytes if the column is nullable.

The maximum Btrieve key size is 255. When a column is nullable and indexed a segmented key is created with 1 byte for the null indicator and a maximum 254 bytes from the column indexed. Varchar columns differ from char columns in that either the length byte (Btrieve lstring) or a zero terminating byte (Btrieve zstring) are reserved, reducing the effective storage by 1 byte.

Pervasive.SQL 2000i nullable columns: For data files with 4096 byte page size, you are limited to 119 index segments per file. Because each indexed nullable column with true null support requires an index consisting of 2 segments, you cannot have more than 59 indexed nullable columns in a table (or indexed nullable true null fields in a Btrieve file). This limit is smaller for smaller page sizes. Any file created with Pervasive.SQL 2000i, with file create mode set to 7.x, and TRUENULLCREATE set to the default value of On, has true null support. Files created using an earlier file format, or with Pervasive.SQL 7, or with TRUENULLCREATE set to Off, do not have true null support and do not have this limitation.

A UNIQUE segment key guarantees that the combination of the segments for a particular row are unique in the file. It does not guarantee or require that each individual segment is unique.

Note All data types can be indexed *except* for the following:
BIT
LONGVARBINARY
LONGVARCHAR
BLOB
CLOB

Examples

The following example creates an index named Dept based on Dept_name in the Faculty table.

```
CREATE INDEX Dept on Faculty(Dept_Name)
```

The following example creates a non-modifiable segmented index in the Person table.

```
CREATE NOT MODIFIABLE INDEX X_Person on Person(ID,
Last_Name)
```

See Also

"DROP INDEX" on page 2-70

CREATE PROCEDURE

The **CREATE PROCEDURE** statement creates a new stored procedure. Stored procedures are SQL statements that are pre-defined and saved in the database dictionary.

Syntax

CREATE PROCEDURE *procedure-name*
([*parameter* [, *parameter*] . . .])
RETURNS (*result* [, *result*] . . .)]
[**WITH DEFAULT HANDLER**]
as-or-semicolon
proc-stmt

procedure-name ::= user-defined-name

parameter ::= *parameter-type-name data-type* [**DEFAULT** *proc-expr* | = *proc-expr*]
| **SQLSTATE**

parameter-type-name ::= parameter-name
| *parameter-type parameter-name*
| *parameter-name parameter-type*

parameter-type ::= **IN** | **OUT** | **INOUT** | **IN_OUT**

parameter-name ::= [:] *user-defined-name*

proc-expr ::= same as normal expression but does not allow IF expression, or ODBC-style scalar functions

result ::= *user-defined-name data-type*

as-or-semicolon ::= **AS** | ;

proc-stmt ::= [*label-name* :] **BEGIN [ATOMIC]** [*proc-stmt* [; *proc-stmt*] . . .] **END** [*label-name*]
| **CALL** *procedure-name* (*proc-expr* [, *proc-expr*] . . .)
| **CLOSE** *cursor-name*
| **DECLARE** *cursor-name* **CURSOR FOR** *select-statement* [**FOR UPDATE** | **FOR READ ONLY**]
| **DECLARE** *variable-name data-type* [**DEFAULT** *proc-expr* | = *proc-expr*]
| **DELETE WHERE CURRENT OF** *cursor-name*
| *delete-statement*

| **FETCH** [*fetch-orientation* [**FROM**]] *cursor-name* [**INTO** *variable-name* [, *variable-name*]]

| **IF** *proc-search-condition* **THEN** *proc-stmt* [; *proc-stmt*] . . . [**ELSE** *proc-stmt* [; *proc-stmt*] . . .] **END IF**

| *insert-statement*

| **LEAVE** *label-name*

| [*label-name* :] **LOOP** *proc-stmt* [; *proc-stmt*] . . . **END LOOP** [*label-name*]

| **OPEN** *cursor-name*

| **PRINT** *proc-expr* [, '*string*']
— applies only to Windows-based platforms

| **RETURN** [*proc-expr*]

| *transaction-statement*

| *select-statement-with-into*

| *select-statement*

| **SET** *variable-name* = *proc-expr*

| **SIGNAL** [**ABORT**] *sqlstate-value*

| **START TRANSACTION**

| *update-statement*

| **UPDATE SET** *column-name* = *proc-expr* [, *column-name* = *proc-expr*] . . . **WHERE CURRENT OF** *cursor-name*

| [*label-name* :] **WHILE** *proc-search-condition* **DO** [*proc-stmt* [; *proc-stmt*]] . . . **END WHILE** [*label-name*]

transaction-statement : : = *commit-statement*

| *rollback-statement*

| *release-statement*

commit-statement : : = see **COMMIT** statement

rollback-statement : : = see **ROLLBACK** statement

release-statement : : = see **RELEASE SAVEPOINT** statement

label-name : : = *user-defined-name*

cursor-name : : = *user-defined-name*

variable-name : : = *user-defined-name* *proc-search-condition* ::= same as normal search-condition, but does not allow any expression that includes a subquery.

fetch-orientation ::= | **NEXT**

sqlstate-value ::= '*string*'

Remarks

To execute stored procedures, use the `CALL` statement.

Note that, in a procedure, the name of a variable and the name of a parameter must begin with a colon (:), both in the definition and use of the variable or parameter.

Statements are delimited with a semi-colon inside stored procedures and triggers.

The **WITH DEFAULT HANDLER** clause, when present, causes the procedure to continue execution when an error occurs. The default behavior (without this clause) is to abort the procedure with SQLSTATE set to the error state generated by the statement.

The use of a *StmtLabel* at the beginning (and optionally at the end) of an **IF** statement is an extension to ANSI SQL 3.

The **PRINT** statement applies only to Windows-based platforms. It is ignored on other operating system platforms.

Examples

The following example creates stored procedure Enrollstudent, which inserts a record into the Enrolls table, given the Student ID and the Class ID.

```
CREATE PROCEDURE  Enrollstudent(IN :Stud_id INTEGER, IN
:Class_Id INTEGER, IN :GPA REAL);
   BEGIN
      INSERT INTO Enrolls VALUES(:Stud_id, :Class_id,
         :GPA);
   END;
CALL  Enrollstudent(1023456781, 146, 3.2)
SELECT  * FROM  Enrolls WHERE Student_id = 1023456781
```

The **CALL** and **SELECT** statements, respectively, call the procedure by passing arguments, then display the row that was added.

The following procedure reads the Class table, using the classId parameter passed in by the caller and validates that the course enrollment is not already at its limit before updating the Enrolls table.

```
CREATE PROCEDURE Checkmax(in :classid integer);
BEGIN
   DECLARE  :numenrolled integer;
   DECLARE :maxenrolled integer;
   SELECT COUNT(*) INTO :numenrolled  FROM  Enrolls
      WHERE class_ID = :classid;
   SELECT Max_size INTO  :maxenrolled  FROM  Class WHERE
      id = :classid;
   IF  (:numenrolled > :maxenrolled)  THEN
      PRINT  'Enrollment Failed. Number of students
         enrolled reached maximum allowed for this
         class' ;
   ELSE
      PRINT  'Enrollment Successful.';
   END  IF;
END;
CALL Checkmax(101)
```

Note that COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

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The following is an example of using the **OUT** parameter when creating stored procedures. Calling this procedure returns the number of students into the variable :outval that satisfies the **WHERE** clause.

```
CREATE PROCEDURE  PROCOUT (out :outval INTEGER)
AS BEGIN
SELECT COUNT(*) INTO :outval FROM Enrolls WHERE Class_Id
   = 101;
END;
```

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The following is an example of using the **INOUT** parameter when creating stored procedures. Calling this procedure requires an INPUT parameter :IOVAL and returns the value of the output in the variable :IOVAL. The procedure sets the value of this variable based on the input and the **IF** condition.

```
CREATE PROCEDURE ProcIODate (INOUT :ioval DATE)
AS BEGIN
    IF :ioval = '1982-03-03'
    THEN
        SET :ioval ='1982-05-05';
    ELSE
        SET :ioval = '1982-03-03';
    END IF;
END;
```

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The following example illustrates using the **RETURNS** clause in a procedure. This sample returns all of the data from the Class table where the Start Date is equal to the date passed in on the **CALL** statement.

```
CREATE PROCEDURE DateReturnProc(IN :pdate DATE)
RETURNS(
    ID INTEGER,
    Name CHAR(7),
    Section CHAR(3),
    Max_Size USMALLINT,
    Start_Date DATE,
    Start_Time TIME,
    Finish_Time TIME,
    Building_Name CHAR(25),
    Room_Number UINTEGER,
    Faculty_ID UBIGINT
    );
        BEGIN
        SELECT * FROM class WHERE Start_Date = :pdate;
        END;

CALL DateReturnProc('2001-06-05')
```

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The following example shows the use of the WHERE CURRENT OF clause, which applies to positioned deletes.

```
CREATE PROCEDURE MyProc(IN :CourseName CHAR(7)) AS
   BEGIN
         DECLARE c1 CURSOR FOR SELECT name FROM course
             WHERE name = :CourseName FOR UPDATE;
          OPEN c1;
          FETCH NEXT FROM c1 INTO :CourseName;
          DELETE WHERE CURRENT OF c1;
          CLOSE c1;
   END;
CALL MyProc('HIS 305')
```

(Note that if you use a **SELECT** inside of a WHERE clause of a **DELETE**, it is a searched **DELETE** not a positioned **DELETE.**)

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The following is an example of using ATOMIC, which groups a set of statements so that either all succeed or all fail. ATOMIC can be used only within the body of a stored procedure or trigger.

The first procedure does not specify ATOMIC, the second does.

```
CREATE TABLE t1 (c1 INTEGER)
CREATE UNIQUE INDEX t1i1 ON t1 (c1)
CREATE PROCEDURE p1 ();
   BEGIN
      INSERT INTO t1 VALUES (1);
      INSERT INTO t1 VALUES (1);
   END;
CREATE PROCEDURE p2 ();
   BEGIN ATOMIC
      INSERT INTO t1 VALUES (2);
      INSERT INTO t1 VALUES (2);
   END;
CALL p1()
CALL p2()
SELECT * FROM t1
```

Both procedures return an error because they attempt to insert duplicate values into a unique index.

The result is that t1 contains only one record because the first **INSERT** statement in procedure p1 succeeds even though the second fails. Likewise, the first **INSERT** statement in procedure p2 succeeds but the second fails. However, since ATOMIC is in procedure p2, all of the work done inside procedure p2 is rolled back when the error is encountered.

Using Stored Procedures

As an example, **CALL** foo(a, b, c) executes the stored procedure "foo" with parameters a, b, and c. Any of the parameters may be a dynamic parameter (such as '?'), which is necessary for retrieving the values of output and inout parameters. For example: **CALL** foo {(?, ?, 'TX')}. The curly braces are optional in your source code.

This is how stored procedures work in the current version of Pervasive.SQL.

- Triggers (**CREATE TRIGGER**, **DROP TRIGGER**) are supported. This support includes tracking dependencies that the trigger has on tables, and procedures, in the database.
- **CONTAINS**, **NOT CONTAINS**, **BEGINS WITH** are not supported.
- There is no support for dynamic SQL statement construction.
- **LOOP**: post conditional loops are not supported (**REPEAT...UNTIL**).
- **ELSEIF**: The conditional format uses **IF ... THEN ... ELSE**. There is no **ELSEIF** support.
- **CASE**: There is no support for **CASE** in stored procedures.

General Stored Procedure Engine Limitations

You should be aware of the following limitations before using stored procedures.

- There is no qualifier support in **CREATE PROCEDURE** or **CREATE TRIGGER.**
- Maximum length of a stored procedure variable name is 128 characters.
- Maximum length of a stored procedure name is 30 characters.
- Only partial syntactical validation occurs at **CREATE PROCEDURE** or **CREATE TRIGGER** time. Column names are not validated until run time.

- There is currently no support for using subqueries everywhere expressions are used. For example, `set :arg = SELECT MIN(sal) FROM emp` is not supported. However, you could rewrite this query as `SELECT min(sal) INTO :arg FROM emp`.
- Only default handler error support.

Limits to SQL Variables and Parameters

- Variable names must be preceded with a colon (:). This allows Pervasive.SQL 2000i Stored Procedure parser to differentiate between variables and column names.
- Variable names are case insensitive.
- No session variables are supported. Variables are local to the procedure.

Limits to Cursors

- Positioned **UPDATE** does not accept tablename.

Limits when using Long Data

- When you pass long data as arguments to an imbedded procedure, (that is, a procedure calling another procedure), the data is truncated to 65500 bytes.
- Long data arguments to and from procedures are limited to a total of 2 MB. (See MAXLEN_LONGPROCDATA define in spm.c)

Internally long data may be copied between cursors with no limit on data length. If a long data column is fetched from one statement and inserted into another, no limit is imposed. If, however, more than one destination is required for a single long data variable, only the first destination table receives multiple calls to PutData. The remaining columns are truncated to the first 65500 bytes. This is a limitation of the ODBC GetData mechanism.

See Also

"DROP PROCEDURE" on page 2-71

CREATE TABLE

The **CREATE TABLE** statement creates a new table in a database.

CREATE TABLE contains functionality that goes beyond minimal or core SQL conformance. **CREATE TABLE** supports Referential Integrity features. Pervasive.SQL conforms closely to SQL 92 with the exception of *ColIDList* support.

Syntax

```
CREATE TABLE table-name [ IN DICTIONARY ]
    [ USING 'path_name'] [ WITH REPLACE ]
    ( table-element [ , table-element ]... )

table-name ::=user-defined-name

table-element ::= column-definition | table-constraint-definition

olumn-definition ::= column-name data-type [ DEFAULT default-value ] [
    column-constraint [ column-constraint ]... [CASE | COLLATE
    collation-name ]

column-name ::= user-defined-name

data-type ::= data-type-name [ (precision [ , scale ] ) ]

precision ::= integer

scale ::= integer

default-value ::= literal

literal ::= 'string'
        | number
        | { d 'date-literal' }
        | { t 'time-literal' }
        | { ts 'timestamp-literal' }

column-constraint ::= [ CONSTRAINT constraint-name ] col-constraint

constraint-name ::= user-defined-name

col-constraint ::= NOT NULL
    | UNIQUE
    | PRIMARY KEY
    | REFERENCES table-name [ ( column-name ) ] [ referential-actions ]
```

table-constraint-definition ::= [**CONSTRAINT** *constraint-name*] *table-constraint*

table-constraint ::= **UNIQUE** (*column-name* [, *column-name*] . . .)
| **PRIMARY KEY** (*column-name* [, *column-name*] . . .)
| **FOREIGN KEY** (*column-name* [, *column-name*])
REFERENCES *table-name*
[(*column-name* [, *column-name*] . . .)]
[*referential-actions*]

column-constraint ::= [**CONSTRAINT** *constraint-name*] *col-constraint*

constraint-name ::= *user-defined-name*

col-constraint ::= **NOT NULL**
| **UNIQUE**
| **PRIMARY KEY**
| **REFERENCES** *table-name* [(*column-name*)] [*referential-actions*]

referential-actions ::= *referential-update-action* [*referential-delete-action*]
| *referential-delete-action* [*referential-update-action*]

referential-update-action ::= **ON UPDATE RESTRICT**

referential-delete-action ::= **ON DELETE CASCADE**
| **ON DELETE RESTRICT**

Remarks

Indexes must be created with the CREATE INDEX statement.

Foreign key constraint names must be unique in the dictionary. All other constraint names must be unique within the table in which they reside and must not have the same name as a column.

If the primary key name is omitted, the name of the first column in the key, prefixed by "PK_" is used as the name of the constraint.

If a reference column is not listed, the reference becomes, by default, the primary key of the table referenced. If a PK is unavailable, a "Key not found" error returns. You can avoid this situation by enumerating the target column.

If the foreign key name is omitted, the name of the first column in the key, prefixed by "FK_" is used as the name of the constraint. This is different behavior from previous versions of Pervasive.SQL.

If the **UNIQUE** key constraint name is omitted, the name of the first column in the constraint, prefixed by "UK_" is used as the name of the constraint.

If the NOT NULL key name is omitted, the name of the first column in the key, prefixed by "NN_" is used as the name of the constraint.

The maximum length of a constraint name is 20 characters. Pervasive.SQL use the left most 20 characters of the name after the prefix, if any, has been prepended.

A foreign key may reference the primary key of the same table (known as a self-referencing key).

If **CREATE TABLE** succeeds, the data file name for the created table is xxx.mkd, where xxx is the specified table name. If the table already exists, it is not replaced, and error -1303, "Table already exists" is signalled. The user must drop the table before replacing it.

Delete Rule

You can include an ON DELETE clause to define the delete rule Pervasive.SQL enforces for an attempt to delete the parent row to which a foreign key value refers. The delete rules you can choose are as follows:

- If you specify CASCADE, Pervasive.SQL uses the *delete cascade* rule. When a user deletes a row in the parent table, Scalable SQL deletes the corresponding row in the dependent table.
- If you specify RESTRICT, Pervasive.SQL enforces the *delete restrict* rule. A user cannot delete a row in the parent table if a foreign key value refers to it.

If you do not specify a delete rule, Pervasive.SQL applies the restrict rule by default.

Update Rule

Pervasive.SQL enforces the *update restrict* rule. This rule prevents the addition of a row containing a foreign key value if the parent table does not contain the corresponding primary key value. This rule is enforced whether or not you use the optional ON UPDATE clause, which allows you to specify the update rule explicitly.

IN DICTIONARY

See the discussion of IN DICTIONARY for“ALTER TABLE” on page 2-19.

USING

The USING keyword allows you to associate a **CREATE TABLE** or **ALTER TABLE** action with a particular data file.

Because Pervasive.SQL requires a Named Database to connect, the *path_name* provided must always be a simple file name or relative path and file name. Paths are always relative to the first Data Path specified for the Named Database to which you are connected.

The path/file name passed is partially validated when SQLPrepare is called. The following rules must be followed when specifying the path name:

- The text must be enclosed in single quotes, as shown in the grammar definition.
- Text must be 1 to 64 characters in length, such that the entry as specified fits in Xf$Loc in X$File. The entry is stored in Xf$Loc exactly as typed (trailing spaces are truncated and ignored).
- The path must be a simple, relative path. Paths that reference a server or volume are not allowed. For NetWare, a volume-based path (such as SYS:/path/testfile.btr) is ***not*** considered a simple, relative path.
- Relative paths containing a period (‘.’ - current directory) , double-period (‘..’ - parent directory), slash ‘\’, or any combination of the three are allowed. The path must contain a file name representing the SQL table name (*path_name* cannot end in a slash ‘\’ or a directory name). All file names, including those specified with relative paths, are relative to the first Data Path as defined in the Named Database configuration.
- Root-based relative paths are also allowed. For example, assuming that the first data path is D:\PVSW\DEMODATA, the SRDE interprets the path name in the following statement as D:\TEMP\TEST123.BTR.

  ```
  CREATE TABLE t1 USING '\temp\test123.btr' (c1 int)
  ```
- Slash (‘\’) characters in relative paths may be specified either UNIX style (‘/’) or in the customary backslash notation (‘\’), depending on your preference. You may use a mixture of the two types, if desired. This is a convenience feature since you may

know the directory structure scheme, but not necessarily know (or care) what type of server you are connected to. The path is stored in X$File exactly as typed. The SRDE engine converts the slash characters to the appropriate platform type when utilizing the path to open the file. Also, since data files share binary compatibility between all supported platforms, this means that as long as the directory structure is the same between platforms (and path-based file names are specified as relative paths), the database files and DDFs can be moved from one platform to another with no modifications. This makes for a much simpler cross-platform deployment with a standardized database schema.

- If specifying a relative path, the directory structure in the USING clause must first exist. The SRDE does not create directories to satisfy the path specified in the USING clause.

Include a USING clause to specify the physical location of the data file associated with the table. This is necessary when you are creating a table definition for an existing data file, or when you want to specify explicitly the name or physical location of a new data file.

If you do not include a USING clause, Pervasive.SQL generates a unique file name (based on the table name with the extension .MKD) and creates the data file in the first directory specified in the data file path associated with the database name.

If the USING clause points to an existing data file, the SRDE creates the table in the DDFs and returns SQL_SUCCESS_WITH_INFO. The informational message returned indicates that the dictionary entry now points to an existing data file. If you want **CREATE TABLE** to return only SQL_SUCCESS, specify IN DICTIONARY on the CREATE statement. If WITH REPLACE is specified (see below), then any existing data file with the same name is destroyed and overwritten with a newly created file.

Note Pervasive.SQL returns a successful status code if you specify an existing data file.

WITH REPLACE

Whenever WITH REPLACE is specified with the USING keyword, Pervasive.SQL automatically overwrites any existing file name with the specified file name. The existing file is always overwritten as long as the operating system allows it.

WITH REPLACE affects only the data file, it never affects the DDFs.

The following rules apply when using WITH REPLACE:

- WITH REPLACE can only be used with USING.
- When used with IN DICTIONARY, WITH REPLACE is ignored because IN DICTIONARY specifies that only the DDFs are affected.

Note No data is lost or discarded if WITH REPLACE is used with **ALTER TABLE**. The newly created data file, even if overwriting an existing file, still contains all data from the previous file. You cannot lose data by issuing an **ALTER TABLE** command.

If you include WITH REPLACE in your **CREATE TABLE** statement, Pervasive.SQL creates a new data file to replace the existing file (if the file exists at the location you specified in the USING clause). Pervasive.SQL discards any data stored in the original file with the same name. If you do not include WITH REPLACE and a file exists at the specified location, Pervasive.SQL returns a status code and does not create a new file.

WITH REPLACE affects only the data file; it does not affect the table definition in the dictionary.

Examples

The following example creates a table named Billing with columns Student_ID, Transaction_Number, Log, Amount_Owed, Amount_Paid, Registrar_ID and Comments, using the specified data types.

```
CREATE TABLE Billing
    (Student_ID  UBIGINT,
    Transaction_Number USMALLINT,
    Log TIMESTAMP,
    Amount_Owed DECIMAL(6,2),
    Amount_Paid DECIMAL(6,2),
    Registrar_ID DECIMAL(10,0),
    Comments LONGVARCHAR)
```

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The following example creates a table named Faculty in the database with columns ID, Dept_Name, Designation, Salary, Building_Name, Room_Number, Rsch_Grant_Amount, and a primary key based on column ID.

```
CREATE TABLE Faculty
     (ID                    UBIGINT,
      Dept_Name             CHAR(20) CASE,
      Designation           CHAR(10) CASE,
      Salary                CURRENCY,
      Building_Name         CHAR(25) CASE,
      Room_Number           UINTEGER,
      Rsch_Grant_Amount     DOUBLE,
PRIMARY KEY (ID))
```

The following example is similar to the one just discussed, except the ID column, which is the primary key, is designated as UNIQUE.

```
CREATE TABLE organizations
   (ID UBIGINT UNIQUE,
   Name LONGVARCHAR,
   Advisor CHAR(30),
   Number_of_people INTEGER,
   Date_started DATE,
   Time_started TIME,
   Date_modified TIMESTAMP,
   Total_funds DOUBLE,
   Budget DECIMAL(2,2),
   Avg_funds REAL,
   President VARCHAR(20) CASE,
   Number_of_executives SMALLINT,
   Number_of_meetings TINYINT,
   Office UTINYINT,
   Active BIT,
PRIMARY KEY(ID))
```

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In the next example, assume that you need a table called StudentAddress to contain students' addresses. You need to alter the Student table's *id* column to be a primary key and then create a

StudentAddress table. (The Student table is part of the DEMODATA sample database.) Four ways are shown how to create the StudentAddress table.

First, make the *id* column of table Student a primary key.

```
ALTER TABLE Student ADD PRIMARY KEY (id)
```

This next statement creates a StudentAddress table to have a foreign key referencing the *id* column of table Student with the DELETE CASCADE rule. This means that whenever a row is deleted from the Student table (Student is the parent table in this case), all rows in the StudentAddress table with that same id are also deleted.

```
CREATE TABLE StudentAddress (id UBIGINT REFERENCES
Student (id) ON DELETE CASCADE, addr CHAR(128))
```

This next statement creates a StudentAddress table to have a foreign key referencing the *id* column of table Student with the **DELETE RESTRICT** rule. This means that whenever a row is deleted from the Student table and there are rows in the StudentAddress table with that same id, an error occurs. You need to explicitly delete all the rows in StudentAddress with that *id* before the row in the Student table, the parent table, can be deleted.

```
CREATE TABLE StudentAddress (id UBIGINT REFERENCES
Student (id) ON DELETE RESTRICT, addr CHAR(128))
```

This next statement creates a StudentAddress table to have a foreign key referencing the *id* column of table Student with the UPDATE RESTRICT rule. This means that if a row is added to the StudentAddress table that has an id that does not occur in the Student table, an error occurs. In other words, you must have a parent row before you can have foreign keys referring to that row. This is the default behavior of Pervasive.SQL. Moreover, Pervasive.SQL does not support any other UPDATE rules. Thus, whether this rule is stated explicitly or not makes no difference.

```
CREATE TABLE StudentAddress (id UBIGINT REFERENCES
Student (id) ON UPDATE RESTRICT, addr CHAR(128))
```

This next statement creates a StudentAddress table to have a foreign key referencing the *id* column of table Student with the **DELETE RESTRICT** and UPDATE RESTRICT rules. The Pervasive.SQL parser accepts this syntax with RI rules. However, as stated above, the UPDATE RESTRICT rule is redundant since Pervasive.SQL does not behave any other way with respect to UPDATE rules.

```
CREATE TABLE StudentAddress (id UBIGINT REFERENCES
Student (id) ON DELETE RESTRICT, addr CHAR(128))
```

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This next example shows how to use an alternate collating sequence (ACS) when you create a table. The ACS file used is the sample one provided with Pervasive.SQL.

```
CREATE TABLE t5 (c1 CHAR(20) COLLATE
'c:\pvsw\samples\upper.alt')
```

Upper.alt treats upper and lower case letters the same for sorting. For example, if a database has values abc, ABC, DEF, and Def, inserted in that ordered, the sorting with upper.alt returns as abc, ABC, DEF, and Def. (The values abc and ABC, and the values DEF and Def are considered duplicates and are returned in the order in which they were inserted.) Normal ASCII sorting sequences upper case letters before lower case, such that the sorting would return as ABC, DEF, Def, abc.

See Also

"DROP TABLE" on page 2-72

CREATE TRIGGER

The **CREATE TRIGGER** statement creates a new trigger in a database. Triggers are a type of stored procedure that are automatically executed when data in a table is modified with an INSERT, UPDATE, or DELETE.

Unlike a regular stored procedure, a trigger cannot be executed directly nor can it have parameters. Triggers do not return a result set nor can they be defined on views.

Syntax

CREATE TRIGGER *trigger-name before-or-after ins-upd-del* **ON** *table-name*
[**ORDER** *number*]
[**REFERENCING** *referencing-alias*] **FOR EACH ROW**
[**WHEN** *proc-search-condition*] *proc-stmt*

trigger-name ::= *user-defined-name*

before-or-after ::= **BEFORE** | **AFTER**

ins-upd-del ::= **INSERT** | **UPDATE** | **DELETE**

referencing-alias ::= **OLD** [**AS**] *correlation-name* [**NEW** [**AS**] *correlation-name*]
| **NEW** [**AS**] *correlation-name* [**OLD** [**AS**] *correlation-name*]

correlation-name ::= *user-defined-name*

Remarks

This function is an extension to SQL grammar as documented in the *Microsoft ODBC Programmer's Reference* and implements a subset of the SQL 3/PSM (Persistent Stored Modules) specification.

Note In a trigger, the name of a variable must begin with a colon (:).

OLD (OLD *correlation-name*) and NEW (NEW *correlation-name*) can be used used inside triggers, not in a regular stored procedure.

In a **DELETE** or **UPDATE** trigger, "OLD" or a OLD *correlation-name* must be prepended to a column name to reference a column in the row of data prior to the update or delete operation.

In an **INSERT** or **UPDATE** trigger, "NEW" or a NEW *correlation-name* must be prepended to a column name to reference a column in the row about to be inserted or updated.

Trigger names must be unique in the dictionary.

Triggers are executed either before or after an **UPDATE**, **INSERT**, or **DELETE** statement is executed, depending on the type of trigger.

Examples

The following example creates a trigger that records any new values inserted into the Tuition table into TuitionIDTable.

```
CREATE TABLE Tuitionidtable (PRIMARY KEY(id), id
UBIGINT)

CREATE TRIGGER  InsTrig

   BEFORE INSERT ON Tuition

   REFERENCING NEW AS Indata

FOR EACH ROW

INSERT INTO Tuitionidtable VALUES(Indata.ID);
```

An **UPDATE** on Tutition calls the trigger.

The following example shows how to keep two tables, A and B, synchronized with triggers. Both tables have the same structure.

```
CREATE TABLE A (col1 INTEGER, col2 CHAR(10))
CREATE TABLE B (col1 INTEGER, col2 CHAR(10))

CREATE TRIGGER MyInsert

   AFTER INSERT ON A FOR EACH ROW

   INSERT INTO B VALUES (NEW.col1, NEW.col2);

CREATE TRIGGER MyDelete

   AFTER DELETE ON A FOR EACH ROW

   DELETE FROM B WHERE B.col1 = OLD.col1 AND B.col2 =
      OLD.col2;

CREATE TRIGGER MyUpdate

   AFTER UPDATE ON A FOR EACH ROW

   UPDATE B SET col1 = NEW.col1, col2 = NEW.col2 WHERE
      B.col1 = OLD.col1 AND B.col2 = OLD.col2;
```

Note that OLD and NEW in the example keep the tables synchronized only if table A is altered with non-positional SQL statements. If the ODBC SQLSetPos API or a positioned update or delete is used, then the tables stay synchronized only if table A does not contain any duplicate records. An SQL statement cannot be constructed to alter one record but leave another duplicate record unaltered.

See Also

"DROP TRIGGER" on page 2-73

CREATE VIEW

Use the **CREATE VIEW** statement to define a stored view on the database.

Syntax

```
CREATE VIEW view-name [ ( column-name [ , column-name ]...) ]
    AS query-specification
```

view-name ::= *user-defined-name*

Remarks

A view is a database object that stores a query and behaves like a table. A view contains a set of columns and rows. Data accessed through a view is stored in one or more tables; the tables are referenced by **SELECT** statements. Data returned by a view is produced dynamically every time the view is referenced.

The maximum length of a view name is 20 characters. The maximum number of columns in a view is 256. There is a 64KB limit on view definitions.

A grouped view is one that contains the **GROUP BY** clause and/or an aggregate function in the **SELECT** list. Grouped views are not allowed in the **FROM** clause of a **SELECT** statement with a join (that is, with multiple tables). Grouped views are not allowed in the **FROM** clause of a **SELECT** statement with a **GROUP BY.**

Grouped views may not be used in a subquery.

The **WHERE** clause against a grouped view is a **HAVING** clause, and appended to the **HAVING** clauses of the grouped view.

View definitions cannot contain **UNION** operators. The operator **UNION** cannot be applied to any SQL statement that references one or more views.

View definitions cannot contain procedures, nor can they contain an **ORDER BY.**

Examples

The following statement creates a view named vw_Person, which creates a phone list of all the people enrolled in a university. This view lists the last names, first names and telephone numbers with a heading for each column. The Person table is part of the DEMODATA sample database.

```
CREATE VIEW vw_Person (lastn,firstn,phone) AS SELECT
Last_Name, First_Name,Phone FROM  Person
```

In a subsequent query on the view, you may use the column headings in your **SELECT** statement, as shown in the next example.

```
SELECT lastn, firstn FROM vw_Person
```

See Also

"DROP VIEW" on page 2-74

DECLARE

Remarks

Use the **DECLARE** statement to define an SQL variable.

In Pervasive.SQL 2000i, this statement is allowed only inside of a stored procedure or a trigger, since cursors and variables are allowed only inside of stored procedures and triggers.

The name of a variable must begin with a colon (:), both in the definition and use of the variable or parameter.

A variable must be declared before it can set to a value.

Examples

The following examples declare the variables :Counter and :CurrentCapacity.

```
DECLARE :counter INTEGER = 0;

DECLARE :CurrentCapacity INTEGER = 0;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

"SET VARIABLE" on page 2-131

DECLARE CURSOR

The **DECLARE CURSOR** statement defines an SQL cursor.

Syntax

DECLARE *cursor-name* **CURSOR FOR** *select-statement*
[**FOR UPDATE** | **FOR READ ONLY**]

Remarks

In Pervasive.SQL 2000i, this statement is only allowed inside of a stored procedure or a trigger, since cursors and variables are only allowed inside of stored procedures and triggers.

The default behavior for cursors is read-only. Therefore, you must use FOR UPDATE to explicitly designate an update (write or delete).

Examples

The following example creates a cursor that selects values from the Degree, Residency, and Cost_Per_Credit columns in the Tuition table and orders them by ID number.

```
DECLARE BTUCursor CURSOR
   FOR SELECT Degree, Residency, Cost_Per_Credit
   FROM Tuition
   ORDER BY ID;
```

The following example uses FOR UPDATE to ensure a delete.

```
CREATE PROCEDURE MyProc(IN :CourseName CHAR(7)) AS
   BEGIN
         DECLARE c1 CURSOR FOR SELECT name FROM course
             WHERE name = :CourseName FOR UPDATE;
          OPEN c1;
          FETCH NEXT FROM c1 INTO :CourseName;
          DELETE WHERE CURRENT OF c1;
          CLOSE c1;
   END;
CALL MyProc('HIS 305')
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

DELETE (positioned)

Use the positioned **DELETE** statement to remove the current row of a view associated with an SQL cursor.

Syntax

DELETE WHERE CURRENT OF *cursor-name*

Remarks

This statement is allowed in stored procedures, triggers, and at the session level.

> **Note** Even though positioned **DELETE** is allowed at the session level, the DECLARE CURSOR statement is not. Use the SQLGetCursorName() API to obtain the cursor name of the active result set.

Examples

The following sequence of statements provide the setting for the positioned **DELETE** statement. The required statements for the positioned **DELETE** statement are **DECLARE CURSOR, OPEN CURSOR**, and **FETCH FROM** *cursorname*.

The Modern European History class has been dropped from the schedule, so this example deletes the row for Modern European History (HIS 305) from the Course table in the sample database:

```
CREATE PROCEDURE DropClass();
   DECLARE  :CourseName CHAR(7);
   DECLARE  c1 CURSOR
   FOR SELECT name
   FROM COURSE
   WHERE name = :CourseName;
BEGIN
   SET  :CourseName  = 'HIS 305';
   OPEN c1;
   FETCH NEXT FROM c1 INTO :CourseName;
   DELETE WHERE CURRENT OF c1;
END;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

DELETE

This statement deletes specified rows from a database table.

Syntax

DELETE FROM *table-name* [*alias-name*]
    [**WHERE** *search-condition*]

Remarks

INSERT, **UPDATE**, and **DELETE** statements behave in an atomic manner. That is, if an insert, update, or delete of more than one row fails, then all insertions, updates, or deletes of previous rows by the same statement are rolled back.

Examples

The following statements deletes the row for first name Ellen from the person table in the sample database.

```
DELETE FROM person WHERE First_Name = 'Ellen'
```

The following statement deletes the row for Modern European History (HIS 305) from the course table in the sample database:

```
DELETE FROM Course WHERE Name = 'HIS 305'
```

DISTINCT

Remarks

Include the **DISTINCT** keyword in your **SELECT** statement to direct Pervasive.SQL to remove duplicate values from the result. By using **DISTINCT**, you can retrieve all unique rows that match the **SELECT** statement's specifications.

The following rules apply to using the **DISTINCT** keyword:

You can use **DISTINCT** in any statement that includes subqueries.

The **DISTINCT** keyword is ignored if the selection list contains an aggregate; the aggregate guarantees that no duplicate rows result.

The following usage of **DISTINCT** is not allowed:

```
SELECT DISTINCT column1, DISTINCT column2
```

Examples

The following statement retrieves all the unique courses taught by Professor Beir (who has a Faculty ID of 111191115):

```
SELECT DISTINCT c.Name
   FROM Course c, class cl
      WHERE c.name = cl.name AND cl.faculty_id =
         '111191115'
```

See Also

"SELECT" on page 2-118

DROP GROUP

This statement drops one or more groups in a secured database.

Syntax

DROP GROUP *group-name* [, *group-name*]...

Remarks

Separate multiple group names with a comma.

Examples

The following example drops the group pervasive.

```
DROP GROUP pervasive
```

The following example uses a list to drop groups.

```
DROP GROUP pervasive_dev, pervasive_marketing
```

See Also

"CREATE GROUP" on page 2-39

DROP INDEX

This statement drops a specific index from a designated table.

Syntax

DROP INDEX [*table-name* .] *index-name*

Examples

The following statement drops the named index from the Faculty table.

```
DROP INDEX Faculty.Dept
```

See Also

"CREATE INDEX" on page 2-40

DROP PROCEDURE

This statement removes one or more stored procedures from the current database.

Syntax

DROP PROCEDURE *procedure-name*

Examples

The following statement drops the stored procedure myproc from the dictionary:

```
DROP PROCEDURE myproc
```

See Also

"CREATE PROCEDURE" on page 2-42

DROP TABLE

This statement removes a table from a designated database.

Syntax

DROP TABLE *table-name* [**IN DICTIONARY**]

Remarks

CASCADE and **RESTRICT** are not supported.

If any triggers depend on the table, the table is not dropped.

If a transaction is in progress and refers to the table, then an error is signalled and the table is not dropped.

The drop of table fails if other tables depend on the table to be dropped.

If a primary key exists, it is dropped. The user need not drop the primary key before dropping the table. If the primary key of the table is referenced by a constraint belonging to another table, then the table is not dropped and an error is signalled.

If the table has any foreign keys, then those foreign keys are dropped.

If the table has any other constraints (for example, **NOT NULL**, **CHECK**, **UNIQUE**, or **NOT MODIFIABLE**), then those constraints are dropped when the table is dropped.

IN DICTIONARY

See the discussion of IN DICTIONARY for“ALTER TABLE” on page 2-19.

Examples

The following statement drops the class table definition from the dictionary.

```
DROP TABLE Class
```

See Also

“ALTER TABLE” on page 2-19

“CREATE TABLE” on page 2-50

DROP TRIGGER

This statement removes a trigger from the current database.

Syntax

DROP TRIGGER *trigger-name*

Examples

The following example drops the trigger named InsTrig.

```
DROP TRIGGER InsTrig
```

See Also

"CREATE TRIGGER" on page 2-59

DROP VIEW

This statement removes a specified view from the database.

Syntax

DROP VIEW *view-name*

Remarks

[**CASCADE | RESTRICT**] is not supported.

Examples

The following statement drops the vw_person view definition from the dictionary.

```
DROP VIEW vw_person
```

See Also

"CREATE VIEW" on page 2-62

END

Remarks See the discussion for **BEGIN [ATOMIC]** on page 2-32.

EXISTS

Remarks

Use the **EXISTS** keyword to test whether rows exist in the result of the subquery. For every row the outer query evaluates, Pervasive.SQL 2000i tests for the existence of a related row from the subquery. Pervasive.SQL 2000i includes in the statement's result table each row from the outer query that corresponds to a related row from the subquery.

Examples

For example, the following statement returns a list containing only persons who have a 4.0 grade point average:

```
SELECT * FROM Person p WHERE EXISTS
    (SELECT * FROM Enrolls e WHERE e.Student_ID = p.id
    AND Grade = 4.0)
```

See Also

"SELECT" on page 2-118

FETCH

Remarks

A **FETCH** statement positions an SQL cursor on a specified row of a table and retrieves values from that row by placing them into the variables in the target list.

Examples

The **FETCH** statement in this example retrieves values from cursor c1 into the CourseName variable. The Positioned **UPDATE** statement in this example updates the row for Modern European History (HIS 305) in the Course table in the DEMODATA sample database:

```
CREATE PROCEDURE UpdateClass();

BEGIN

   DECLARE :CourseName CHAR(7);

   DECLARE :OldName CHAR(7);

   DECLARE  c1 CURSOR FOR SELECT name FROM course WHERE
      name = :CourseName;

   OPEN c1;

   SET :CourseName = 'HIS 305';

   FETCH NEXT FROM c1 INTO :OldName;

   UPDATE SET name = 'HIS 306' WHERE CURRENT OF c1;
END;
```

See Also

"CREATE PROCEDURE" on page 2-42

FOREIGN KEY

Remarks

Include the **FOREIGN KEY** keywords in the ADD clause to add a foreign key to a table definition.

If you add a foreign key to a table that already contains data, use the Pervasive Control Center utility to find any data that does not conform to the new referential constraint. See the *Pervasive.SQL User's Guide* for information about this utility.

> **Note** You must be logged in to the database using a database name before you can add a foreign key or conduct any other referential integrity (RI) operation. Also, when security is enabled, you must have the Reference right on the table to which the foreign key refers before you can add the key.

Include a **FOREIGN KEY** clause in your **CREATE TABLE** statement to define a foreign key on a dependent table. In addition to specifying a list of columns for the key, you can define a name for the key.

The columns in the foreign key column may be nullable; however, you should ensure that pseudo-null columns do not exist in a MicroKernel index that does not index pseudo-null values.

The foreign key name must be unique in the dictionary. If you omit the foreign key name, Pervasive.SQL uses the name of the first column in the key as the foreign key name. This can cause a duplicate foreign key name error if your dictionary already contains a foreign key with that name.

When you specify a foreign key, Pervasive.SQL creates an index on the columns that make up the key. This index has the same attributes as the index on the corresponding primary key except that it allows duplicate values. To assign other attributes to the index, create it explicitly using a **CREATE INDEX** statement. Then, define the foreign key with an **ALTER TABLE** statement. When you create the index, ensure that it does not allow null values and that its case and collating sequence attributes match those of the index on the corresponding primary key column.

The columns in a foreign key must be the same data types and lengths and in the same order as the referenced columns in the primary key. The only exception is that you can use an integer column in the foreign key to refer to an IDENTITY or

SMALLIDENTITY column in the primary key. In this case, the two columns must be the same length.

Pervasive.SQL checks for anomalies in the foreign keys before it creates the table. If it finds conditions that violate previously defined referential integrity (RI) constraints, it generates a status code and does not create the table.

When you define a foreign key, you must include a REFERENCES clause indicating the name of the table that contains the corresponding primary key. The primary key in the parent table must already be defined. In addition, if security is enabled on the database, you must have the Reference right on the table that contains the primary key.

You cannot create a self-referencing foreign key with the **CREATE TABLE** statement. Use an **ALTER TABLE** statement to create a foreign key that references the primary key in the same table.

Also, you cannot create a primary key and a foreign key on the same set of columns in a single statement. Therefore, if the primary key of the table you are creating is also a foreign key on another table, you must use an **ALTER TABLE** statement to create the foreign key.

Examples

The following statement adds a new foreign key to the Class table. (The Faculty column is defined as an index that does not include null values.)

```
ALTER TABLE Class ADD CONSTRAINT Teacher FOREIGN KEY
(Faculty_ID)
REFERENCES Faculty ON DELETE RESTRICT
```

In this example, the restrict rule for deletions prevents someone from removing a faculty member from the database without first either changing or deleting all of that faculty's classes.

See Also

"ALTER TABLE" on page 2-19

"CREATE TABLE" on page 2-50

GRANT

This statement creates new user IDs and gives permissions to specific users in a secured database.

Syntax

GRANT CREATETAB TO *public-or-user-or-group-name* [, *user-or-group-name*] . . .

GRANT LOGIN TO *user-password* [, *user-password*] . . . [**IN GROUP** *group-name*]

GRANT *table-privilege* **ON** [**TABLE**] *table-name* [*owner-name*]
TO *user-or-group-name* [, *user-or-group-name*] . . .

table-privilege : : = **ALL**
| **SELECT** [(*column-name* [, *column-name*] . . .)]
| **UPDATE** [(*column-name* [, *column-name*] . . .)]
| **INSERT** [(*column-name* [, *column-name*] . . .)]
| **DELETE**
| **ALTER**
| **REFERENCES**

user-password : : = *user-name* [:] *password*

public-or-user-or-group-name : : = **PUBLIC** | *user-or-group-name*

user-or-group-name : : = *user-name* | *group-name*

user-name : : = *user-defined-name*

owner-name :: = user-defined-name

Remarks

CREATETAB and **LOGIN** arguments are extensions to the core SQL grammar.

Although an optional column list is in the syntax for the **INSERT, ALTER**, and **REFERENCES** privileges, the Pervasive.SQL Engine signals a "not supported" error if any **GRANT INSERT, GRANT ALTER**, or **GRANT REFERENCES** statement contains a column list.

Note ANSI SQL 3 permits column lists for **INSERT**, **ALTER**, **REFERENCES**, **SELECT** and **UPDATE**.

Users and Groups

Relational security is based on the existence of a default user named "Master" who has full access to the database when security is first turned on. Initially, no password is required for the Master user.

Caution If you turn on security, be sure to specify a password with a significant length, at least five characters. Do not leave the password field blank because doing so creates a major security risk for your database.

The Master user can create groups and other users and define sets of data access privileges for these groups and users.

If you want to grant the same level of access to all users and avoid having to set up individual groups and users, you can grant the desired level of access to PUBLIC. The default user PUBLIC represents any user connecting with or without a password.

Note If you wish to use groups, you must set up the groups before creating users. You cannot add a user to a group after you have already created the user.

You can use the **Users** node in PCC to perform these tasks. You can also use **GRANT** and **REVOKE** statements to perform these tasks.

User name and password must be enclosed in double quotes if they contain spaces or other non-alphanumeric characters.

See *Pervasive.SQL User's Guide* for further information about users and groups.

Owner Name

An owner name is a password required to gain access to a Btrieve file. There is no relation between an owner name and any system user name or database user name. You should think of an owner name as a simple file password.

If you have a Btrieve owner name set on a file that is a table in a secure ODBC database, the Master user of the ODBC database must use the owner name in any **GRANT** statement to grant privileges on the given table to any user, including the Master user.

After the **GRANT** statement containing the owner name has been issued for a given user, that user can access the specified table by logging into the database, without specifying the owner name each time.

If a user tries to access a table through ODBC that has a Btrieve owner name, the access will not be allowed unless the Master user has granted privileges on the table to the user, with the correct owner name in the **GRANT** statement.

If a table has an owner name with the Read-Only attribute, the Master user automatically has **SELECT** rights on this table without specifically granting himself/herself the **SELECT** rights with the owner name.

Examples

A **GRANT ALL** statement grants the **INSERT, UPDATE, ALTER, SELECT, DELETE** and **REFERENCES** rights to the specified user or group. In addition, the user or group is granted the **CREATE TABLE** right for the dictionary.

The following statement grants all these privileges to dannyd for table Class.

```
GRANT ALL ON Class TO dannyd
```

This statement grants the **ALTER** privilege to user debieq.

```
GRANT ALTER ON Class TO debieq
```

The following statement gives **INSERT** privileges to keithv and miked on table Class.

```
GRANT INSERT ON Class TO keithv, miked
```

▼▼▼

The following statement grants **INSERT** privileges on two columns, First_name and Last_name, in the person table to users keithv and brendanb

```
GRANT INSERT(First_name,last_name) ON Person to
keithv,brendanb
```

▼▼▼

The following example grants **CREATE TABLE** rights to users aideenw and punitas

```
GRANT  CREATETAB TO aideenw, punitas
```

▼▼▼

This next statement grants login rights to a user named ravi and specifies his password as “password.”

```
GRANT LOGIN TO ravi:password
```

The user name and password refer to Pervasive.SQL databases and are not related to user names and passwords set at level of the operating system. Pervasive.SQL user names, groups, and passwords are set through the Pervasive Control Center (PCC).

The following example grants login rights to users named dannyd and travisk and specifies their passwords as 'password' and 1234567 respectively.

```
GRANT LOGIN TO dannyd:password,travisk:1234567
```

If there are spaces in a name you may use double quotes as in the following example. This statement grants login rights to user named Jerry Gentry and Punita and specifies their password as sun and moon respectively

```
GRANT LOGIN TO 'Jerry Gentry' :sun, Punita:moon
```

The following example grants the login rights to a user named Jerry Gentry with password 123456 and a user named travisk with password abcdef. It also adds them to the group pervasive_dev

```
GRANT LOGIN TO 'Jerry Gentry' :123456, travisk:abcdef IN
GROUP pervasive_dev
```

▼▼▼

To grant privileges on a table that has a Btrieve owner name, the Master user has to supply the correct owner name in the GRANT statement.

The following example grants the **SELECT** rights to the Master user on table T1 that has a Btrieve owner name of “abcd.”

```
GRANT SELECT ON T1 'abcd' TO Master
```

The Master user has all rights on a table that does not have an owner name. You can set an owner name on a table with the Maintenance utility. The Btrieve owner name is case sensitive.

See Also

"REVOKE" on page 2-112

"SET SECURITY" on page 2-129

"CREATE GROUP" on page 2-39

"DROP GROUP" on page 2-69

GROUP BY

Remarks

In addition to the **GROUP BY** syntax in a **SELECT** statement as specified in the *Microsoft ODBC Programmer's Reference*, the Pervasive.SQL Engine supports an extended **GROUP BY** syntax that can include vendor strings.

A **GROUP BY** query returns a result set which contains one row of the select list for every group encountered. (See the *Microsoft ODBC Programmer's Reference* for the syntax of a select list.)

Examples

The following example uses the course table to produce a list of unique departments:

```
SELECT Dept_Name FROM Course GROUP BY Dept_Name
```

In the next example, the result set contains a list of unique departments and the number of courses in each department:

```
SELECT Dept_Name, COUNT(*) FROM Course GROUP BY
Dept_Name
```

Note that COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

▼▼▼

The rows operated on by the set function are those rows remaining after the **WHERE** search condition is applied. In this example, only those rows in the faculty table that have Salary > 80000 are counted:

```
SELECT COUNT(*) FROM Faculty WHERE Salary > 80000 GROUP
BY Dept_Name
```

▼▼▼

The following example shows an extended **GROUP BY** that includes vendor strings.

```
SELECT(--(*vendor(Microsoft), product(ODBC) fn
left(at1.col2, 1) *)--) FROM at1 GROUP BY (--
(*vendor(Microsoft), product(ODBC) fn left(at1.col2, 1)
*)--) ORDER BY (--(*vendor(Microsoft), product(ODBC) fn
left(at1.col2, 1) *)--) DESC
```

See Also

"SELECT" on page 2-118

"GRANT" on page 2-80

"REVOKE" on page 2-112

HAVING

Remarks

Use a **HAVING** clause in conjunction with a **GROUP BY** clause within **SELECT** statements to limit your view to groups whose aggregate values meet specific criteria.

The expressions in a **HAVING** clause may contain constants, set functions or an exact replica of one of the expressions in the **GROUP BY** expression list.

The Pervasive.SQL Engine does not support **HAVING** without **GROUP BY.**

Examples

The following example returns department names where the count of course names is greater than 5.

```
SELECT Dept_Name, COUNT(*) FROM Course GROUP BY
Dept_Name HAVING COUNT(*) > 5
```

Note that COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

▾ ▾ ▾

The next example returns department name that matches Accounting and has a number of courses greater than 5.

```
SELECT Dept_Name, COUNT(*) FROM Course GROUP BY
Dept_Name HAVING COUNT(*)  > 5 AND Dept_Name =
'Accounting'
```

See Also

"SELECT" on page 2-118

IF

Remarks

IF statements provide conditional execution based on the value of a condition. The **IF . . . THEN . . .** [**ELSE . . .**] construct controls flow based on which of two statement blocks will be executed.

You may use **IF** statements in the body of both stored procedures and triggers.

Examples

The following example uses the **IF** statement to set the variable Negative to either 1 or 0, depending on whether the value of vInteger is positive or negative.

```
IF (:vInteger < 0) THEN
    SET :Negative = '1';
    ELSE
    SET :Negative = '0';
    END IF;
```

▾ ▾ ▾

The following example uses the **IF** statement to test the loop for a defined condition (SQLSTATE = '02000'). If it meets this condition, then the **WHILE** loop is terminated.

```
FETCH_LOOP:
    WHILE (:counter < :NumRooms) DO
        FETCH NEXT FROM cRooms INTO :CurrentCapacity;
        IF (SQLSTATE = '02000') THEN
        LEAVE FETCH_LOOP;
        END IF;
        SET :counter = :counter + 1;
        SET :TotalCapacity = :TotalCapacity +
        :CurrentCapacity;
    END WHILE;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

IN

Remarks

Use the **IN** operator to test whether the result of the outer query is included in the result of the subquery. The result table for the statement includes only rows the outer query returns that have a related row from the subquery.

Examples

The following example lists the names of all students who have taken Chemistry 408:

```
SELECT p.First_Name + '  ' +  p.Last_Name
   FROM Person p, Enrolls e
      WHERE (p.id = e.student_id)
      AND (e.class_id IN
      (SELECT c.ID FROM Class c WHERE c.Name = 'CHE
         408'))
```

Pervasive.SQL first evaluates the subquery to retrieve the ID for Chemistry 408 from the Class table. It then performs the outer query, restricting the results to only those students who have an entry in the Enrolls table for that course.

Often, you can perform **IN** queries more efficiently using either the **EXISTS** keyword or a simple join condition with a restriction clause. Unless the purpose of the query is to determine the existence of a value in a subset of the database, it is more efficient to use the simple join condition because Pervasive.SQL optimizes joins more efficiently than it does subqueries.

See Also

"SELECT" on page 2-118

INSERT

This statement inserts column values into one or more tables.

Syntax

```
INSERT INTO table-name [ alias-name ]
    [ ( column-name [ , column-name ]...) ]
    insert-values

insert-values ::= values-clause
    | query-specification

values-clause ::= VALUES ( expression [ , expression ]... )
```

Remarks

INSERT, **UPDATE**, and **DELETE** statements behave in an atomic manner. That is, if an insert, update, or delete of more than one row fails, then all insertions, updates, or deletes of previous rows by the same statement are rolled back.

All data types for data created prior to Pervasive.SQL 2000 (legacy data) report back as nullable. This means that you can INSERT NULL into any legacy column type without pseudo-NULL conversion. The following data types are treated as pseudo-NULL by default:

Date	Decimal	Money	Numeric
NumericSA	NumericSTS	Timestamp	

(Normally, when you convert a legacy column to pseudo-NULL, you lose one of the binary values, forfeiting it so that you can query the column for NULL. These data types, however, because of their design, have a different, unique internal value for NULL in addition to their normal data range. With these data types, no binary values are lost if they are converted to NULL so there is no harm considering them as pseudo-NULL by default.)

The rest of the data types are considered "legacy nullable," meaning that NULL may be inserted into them. When values are queried, however, the non-NULL binary equivalent is returned. This same binary equivalent must be used in WHERE clauses to retrieve specific values.

The binary equivalents are:

- 0 for Binary types
- Empty string from string and BLOB types (legacy types LVAR and NOTE)

CURTIME, CURDATE and NOW variables

Pervasive.SQL 2000i allows you to use the variables CURTIME, CURDATE and NOW in **INSERT** statements to insert the current date, time and timestamp values.

Examples

The following statement adds data to the Course table by directly specifying the values in three VALUES clauses:

```
INSERT INTO Course(Name, Description, Credit_Hours)
   VALUES ('CHE 308', 'Organic Chemistry II', 4)
INSERT INTO Course(Name, Description, Credit_Hours)
   VALUES ('ENG 409', 'Creative Writing II', 3)
INSERT INTO Course(Name, Description, Credit_Hours)
   VALUES ('MAT 307', 'Probability II', 4)
```

▼▼▼

The following **INSERT** statement uses a **SELECT** clause to retrieve from the Student table the ID numbers of students who have taken classes.

The statement then inserts the ID numbers into the Billing table.

```
INSERT INTO Billing (Student_ID)
   SELECT ID
   FROM Student
   WHERE Cumulative_Hours > 0
```

▼▼▼

The following example illustrates the use of the CURTIME, CURDATE and NOW variables to insert the current date, time and timestamp values inside an **INSERT** statement.

```
CREATE TABLE Timetbl (c1 TIME, c2 DATE, c3 TIMESTAMP)
   INSERT INTO Timetbl(c1, c2, c3) VALUES(CURTIME,
      CURDATE, NOW)
```

▼▼▼

The following example shows what occurs when you use **INSERT** for IDENTITY columns and columns with default values.

```
CREATE TABLE (id IDENTITY, c1 INTEGER DEFAULT 100)

INSERT INTO (id) VALUES (0)

INSERT INTO t VALUES (0,1)

INSERT INTO t VALUES (10,10)

INSERT INTO t VALUES (0,2)

INSERT INTO t (c1) VALUES (3)

SELECT * FROM t
```

The **SELECT** shows the table contains the following rows:

```
1, 100
2, 1
10, 10
11, 2
12, 3
```

The first row illustrates that if “0” is specified in the VALUES clause for an IDENTITY column, then the value inserted is “1” if the table is empty.

The first row also illustrates that if no value is specified in the VALUES clause for a column with a default value, then the specified default value is inserted.

The second row illustrates that if “0” is specified in the VALUES clause for an IDENTITY column, then the value inserted is one greater than the largest value in the IDENTITY column.

The second row also illustrates that if a value is specified in the VALUES clause for a column with a default value, then the specified value overrides the default value.

The third row illustrates that if a value other than “0” is specified in the VALUES clause for an IDENTITY column, then that value is inserted. If a row already exists that contains the specified value for the IDENTITY column, then the message “The record has a key field containing a duplicate value(Btrieve Error 5)” is returned and the **INSERT** fails.

The fourth rows shows again that if “0” is specified in the VALUES clause for an IDENTITY column, then the value inserted is one greater than the largest value in the IDENTITY column. This is true even if “gaps” exist between the values (that is, the absence of one or more rows with IDENTITY column values less than the largest value).

The fifth row illustrates that if no value is specified in the VALUES clause for an IDENTITY column, then the value inserted is one greater than the largest value in the IDENTITY column.

See Also

“CREATE TABLE” on page 2-50

“SELECT” on page 2-118

JOIN

You can specify a single table or view, multiple tables, or a single view and multiple tables. When you specify more than one table, the tables are said to be joined.

Syntax

join-definition ::= *table-reference* [**INNER**] **JOIN** *table-reference* **ON** *search-condition*

| *table-reference* **CROSS JOIN** *table-reference*

| *outer-join-definition*

outer-join-definition ::= *table-reference outer-join-type* **JOIN** *table-reference* **ON** *search-condition*

outer-join-type ::= **LEFT** [**OUTER**] | **RIGHT** [**OUTER**] | **FULL** [**OUTER**]

The following example illustrates a two-table outer join:

```
SELECT * FROM Person LEFT OUTER JOIN Faculty ON Person.ID
   = Faculty.ID
```

The following example shows an outer join embedded in a vendor string. The “OJ” can be either upper or lower case.

```
SELECT t1.deptno, ename FROM {OJ emp t2 LEFT OUTER JOIN
   dept t1 ON t2.deptno=t1.deptno}
```

The Pervasive ODBC Engine Interface supports two-table outer joins as specified in the *Microsoft ODBC Programmer’s Reference.*

In addition to simple two-table outer joins, the Pervasive ODBC Engine Interface supports n-way nested outer joins.

The outer join may or may not be embedded in a vendor string. If a vendor string is used, Pervasive ODBC Engine Interface strips it off and parses the actual outer join text.

LEFT OUTER

The Pervasive.SQL Engine has implemented **LEFT OUTER JOIN** using SQL92 (SQL2) as a model. The syntax is a subset of the entire SQL92 syntax which includes cross joins, right outer joins, full outer joins, and inner joins. The TableRefList below occurs after the **FROM** keyword in a **SELECT** statement and before any subsequent **WHERE, HAVING,** and other clauses. Note the recursive nature of TableRef and LeftOuterJoin—a TableRef can be a left outer join that can include TableRefs which, in turn, can be left outer joins and so forth.

```
TableRefList :
    TableRef [, TableRefList]
    | TableRef
    | OuterJoinVendorString [, TableRefList]
TableRef :
    TableName [CorrelationName]
    | LeftOuterJoin
    | ( LeftOuterJoin )
LeftOuterJoin :
TableRef LEFT OUTER JOIN TableRef ON SearchCond
```

The search condition (SearchCond) contains join conditions which in their usual form are *LT.ColumnName = RT.ColumnName*, where *LT* is left table, *RT* is right table, and *ColumnName* represents some column within a given domain. Each predicate in the search condition must contain some non-literal expression.

The implementation of left outer join goes beyond the syntax in the *Microsoft ODBC Programmer's Reference.*

Vendor Strings

The syntax in the previous section includes but goes beyond the ODBC syntax in the *Microsoft ODBC Programmer's Reference.* Furthermore, the vendor string escape sequence at the beginning and end of the left outer join does not change the core syntax of the outer join.

The Pervasive.SQL Engine accepts outer join syntax without the vendor strings. However, for applications that want to comply with ODBC across multiple databases, the vendor string construction should be used. Because ODBC vendor string outer joins do not support more than two tables, it may be necessary to use the syntax shown following Table 2-10 on page 2-96 .

Examples

The following four tables are used in the examples in this section.

Table 2-7 Emp Table

FirstName	LastName	DeptID	EmpID
Franky	Avalon	D103	E1
Gordon	Lightfoot	D102	E2
Lawrence	Welk	D101	E3
Bruce	Cockburn	D102	E4

Table 2-8 Dept Table

DeptID	LocID	Name
D101	L1	TV
D102	L2	Folk

Table 2-9 Addr Table

EmpID	Street
E1	101 Mem Lane
E2	14 Young St.

Table 2-10 Loc Table

LocID	Name
L1	PlanetX
L2	PlanetY

The following example shows a simple two-way Left Outer Join:

```
SELECT * FROM Emp LEFT OUTER JOIN Dept ON Emp.DeptID =
Dept.DeptID
```

This two-way outer join produces the following result set:

Table 2-11 Two-way Left Outer Join

Emp				Dept		
FirstName	LastName	DeptID	EmpID	DeptID	LocID	Name
Franky	Avalon	D103	E1	NULL	NULL	NULL
Gordon	Lightfoot	D102	E2	D102	L2	Folk
Lawrence	Welk	D101	E3	D101	L1	TV
Bruce	Cockburn	D102	E4	D102	L2	Folk

Notice the **NULL** entry for Franky Avalon in the table. That is because no DeptID of D103 was found in the *Dept* table. In a standard (**INNER**) join, Franky Avalon would have been dropped from the result set altogether.

Algorithm

The algorithm that the Pervasive.SQL 2000i Engine uses for the previous example is this:
taking the left table, traverse the right table, and for every case where the **ON** condition is **TRUE** for the current right table row, return a result set row composed of the appropriate right table row appended to the current left-table row.

If there is no right table row where the **ON** condition is **TRUE**, (it is **FALSE** for all right table rows given the current left table row), create a row instance of the right table with all column values **NULL**.

That result set, combined with the current left-table row for each row, is indexed in the returned result set. The algorithm is repeated for every left table row to build the complete result set. In the simple two-way left outer join shown previously, *Emp* is the left table and *Dept* is the right table.

Note Although irrelevant to the algorithm, the appending of the left table to the right table assumes proper projection as specified in the select list of the query. This projection ranges from all columns (for example, **SELECT** * **FROM** . . .) to only one column in the result set (for example, **SELECT** FirstName **FROM** . . .) .

With radiating left outer joins, all other tables are joined onto one central table. In the following example of a three-way radiating left outer join, *Emp* is the central table and all joins radiate from that table.

```
SELECT * FROM (Emp LEFT OUTER JOIN Dept ON Emp.DeptID =
Dept.DeptID) LEFT OUTER JOIN Addr ON Emp.EmpID =
Addr.EmpID
```

Table 2-12 Three-way Radiating Left Outer Join

Emp				**Dept**			**Addr**	
First Name	Last Name	Dept ID	Emp ID	Dept ID	Loc ID	Name	Emp ID	Street
Franky	Avalon	D103	E1	NULL	NULL	NULL	E1	101 Mem Lane
Gordon	Lightfoot	D102	E2	D102	L2	Folk	E2	14 Young St
Lawrence	Welk	D101	E3	D101	L1	TV	NULL	NULL
Bruce	Cockburn	D102	E4	D101	L1	TV	NULL	NULL

In a chaining left outer join, one table is joined to another, and that table, in turn, is joined to another. The following example illustrates a three-way chaining left outer join:

```
SELECT * FROM (Emp LEFT OUTER JOIN Dept ON Emp.DeptID =
Dept.DeptID) LEFT OUTER JOIN Loc ON Dept.LocID =
Loc.LocID
```

Table 2-13 Three-way Chaining Left Outer Join

Emp				**Dept**			**Loc**	
First Name	Last Name	Dept ID	Emp ID	Dept ID	Loc ID	Name	Loc ID	Name
Franky	Avalon	D103	E1	NULL	NULL	NULL	NULL	NULL
Gordon	Lightfoot	D102	E2	D102	L2	Folk	L2	PlanetY
Lawrence	Welk	D101	E3	D101	L1	TV	L1	PlanetX
Bruce	Cockburn	D102	E4	D101	L1	TV	L1	PlanetX

This join could also be expressed as:

```
SELECT * FROM Emp LEFT OUTER JOIN (Dept LEFT OUTER JOIN
Loc ON Dept.LocID = Loc.LocID) ON Emp.DeptID =
Dept.DeptID
```

We recommend the first syntax because it lends itself to both the radiating and chaining joins. This second syntax cannot be used for radiating joins because nested left outer join **ON** conditions cannot reference columns in tables outside their nesting. In other words, in the following query, the reference to Emp.EmpID is illegal:

```
SELECT * FROM Emp LEFT OUTER JOIN (Dept LEFT OUTER JOIN
Addr ON Emp.EmpID = Addr.EmpID) ON Emp.DeptID =
Dept.DeptID
```

The following example shows a three-way radiating left outer join, less optimized:

```
SELECT * FROM Emp E1 LEFT OUTER JOIN Dept ON E1.DeptID =
Dept.DeptID, Emp E2 LEFT OUTER JOIN Addr ON E2.EmpID =
Addr.EmpID WHERE E1.EmpID = E2.EmpID
```

Table 2-14 Three-way Radiating Left Outer Join, Less Optimized

Emp				**Dept**			**Addr**	
First Name	Last Name	Dept ID	Emp ID	Dept ID	Loc ID	Name	Emp ID	Street
Franky	Avalon	D103	E1	NULL	NULL	NULL	E1	101 Mem Lane

Table 2-14 Three-way Radiating Left Outer Join, Less Optimized

Emp				Dept			Addr	
Gordon	Lightfoot	D102	E2	D102	L2	Folk	E2	14 Young St
Lawrence	Welk	D101	E3	D101	L1	TV	NULL	NULL
Bruce	Cockburn	D102	E4	D101	L1	TV	NULL	NULL

This query returns the same results as shown in Table 2-13, assuming there are no **NULL** values for EmpID in Emp and EmpID is a unique valued column. This query, however, is not optimized as well as the one show for Table 2-13 and can be much slower.

See Also

"SELECT" on page 2-118

LEAVE

Remarks

A **LEAVE** statement continues execution by leaving a block or loop statement. You can use **LEAVE** statements in the body of a stored procedure or a trigger.

Examples

The following example increments the variable vInteger by 1 until it reaches a value of 11, when the loop is ended with a **LEAVE** statement.

```
TestLoop:
LOOP
    IF (:vInteger > 10) THEN
        LEAVE TestLoop;
    END IF;
    SET :vInteger = :vInteger + 1;
END LOOP;
```

See Also

"IF" on page 2-88

"LOOP" on page 2-102

LOOP

Remarks

A **LOOP** statement repeats the execution of a block of statements.

This statement is only allowed in stored procedures and triggers.

Pervasive.SQL does not support post-conditional loops (**REPEAT...UNTIL**).

Examples

The following example increments the variable vInteger by 1 until it reaches a value of 11, when the loop is ended.

```
TestLoop:
LOOP
    IF (:vInteger > 10) THEN
        LEAVE TestLoop;
    END IF;
    SET :vInteger = :vInteger + 1;
END LOOP;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

"IF" on page 2-88

NOT

Remarks

Using the **NOT** keyword with the **EXISTS** keyword allows you to test whether rows do not exist in the result of the subquery. For every row the outer query evaluates, Pervasive.SQL tests for the existence of a related row from the subquery. Pervasive.SQL excludes from the statement's result table each row from the outer query that corresponds to a related row from the subquery.

Including the **NOT** keyword along with the **IN** operator allows you to test whether the result of the outer query is not included in the result of the subquery. The result table for the statement includes only rows the outer query returns that do not have a related row from the subquery.

Examples

The following statement returns a list of students who are not enrolled in any classes:

```
SELECT * FROM Person p WHERE NOT EXISTS
   (SELECT * FROM Student s WHERE s.id = p.id
   AND Cumulative_Hours = 0)
```

See Also

"SELECT" on page 2-118

OPEN

Remarks

The **OPEN** (cursor) statement opens a cursor. A cursor must be defined before it can be opened.

This statement is allowed only inside of a stored procedure or a trigger, since cursors and variables are only allowed inside of stored procedures and triggers.

Examples

The following example opens the declared cursor BTUCursor.

```
DECLARE BTUCursor CURSOR
    FOR SELECT Degree, Residency, Cost_Per_Credit
    FROM Tuition
    ORDER BY ID;
OPEN BTUCursor;
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

"DECLARE CURSOR" on page 2-65

PRIMARY KEY

Remarks

Include **PRIMARY KEY** in the **ADD** clause to add a primary key to a table definition.

Before adding the primary key, you must ensure that the columns in the primary key column list are defined as a unique index that does not include null values. If such an index does not exist, create one with the **CREATE INDEX** statement.

Because a table can have only one primary key, you cannot add a primary key to a table that already has a primary key defined. To change the primary key of a table, delete the existing key using a **DROP** clause in an **ALTER TABLE** statement and add the new primary key.

Note You must be logged in to the database using a database name before you can add a primary key or conduct any other referential integrity (RI) operation.

Include a **PRIMARY KEY** clause with the **CREATE TABLE** statement to define the key.

To define referential constraints on your database, you must include a **PRIMARY KEY** clause to specify the primary key on the parent table. The primary key can consist of one column or multiple columns but can only be defined on columns that are not null. The columns you specify must also appear in the column Definitions list of the **CREATE TABLE** statement.

You must define the columns that make up a primary key as a unique index that does not include null values. When you specify a primary key, Pervasive.SQL creates an index with the specified attributes on the defined group of columns.

Examples

The following statement defines a primary key on a table called Faculty. (The ID column is defined as a unique index that does not include null values.)

```
ALTER TABLE Faculty ADD PRIMARY KEY (ID)
```

See Also

"ALTER TABLE" on page 2-19

"CREATE TABLE" on page 2-50

PUBLIC

Remarks

You can include the **PUBLIC** keyword in the **FROM** clause to revoke the Create Table right from all the users to whom the right was not explicitly assigned.

Include a **FROM** clause to specify the group or user from whom you are revoking rights. You can specify a single name or a list of names, or you can include the **PUBLIC** keyword to revoke access rights from all users whose rights are not explicitly assigned.

Examples

To assign access rights to all users in the dictionary, include the **PUBLIC** keyword to grant the rights to the **PUBLIC** group, as in the following example:

```
GRANT SELECT ON Course TO PUBLIC
```

This statement assigns the Select right on the Course table to all users defined in the dictionary. If you later revoke the Select right from the PUBLIC group, only users who are granted the Select right explicitly can access the table.

The following statement includes the **PUBLIC** keyword to grant the Create Table right to all the users defined in the dictionary:

```
GRANT CREATETAB TO PUBLIC
```

See Also

"GRANT" on page 2-80

"REVOKE" on page 2-112

PRINT

Remarks

Use **PRINT** to print variable values or constants. The PRINT statement applies only to Windows-based platforms. It is ignored on other operating system platforms.

You can use **PRINT** only within stored procedures.

Examples

The following example prints the value of the variable :myvar.

```
PRINT( :myvar );
```

```
PRINT 'MYVAR = ' + :myvar;
```

The following example prints a text string followed by a numeric value. You must convert a number value to a text string to print the value.

```
PRINT 'Students enrolled in History 101: ' +
convert(:int_val, SQL_CHAR);
```

See Also

"CREATE PROCEDURE" on page 2-42

RELEASE SAVEPOINT

Use the **RELEASE SAVEPOINT** statement to delete a savepoint.

Syntax

RELEASE SAVEPOINT *savepoint-name*

savepoint-name ::= *user-defined-name*

Remarks

RELEASE, **ROLLBACK**, and **SAVEPOINT** and are supported at the session level (outside of stored procedures) only if AUTOCOMMIT is off. Otherwise, **RELEASE**, **ROLLBACK**, and **SAVEPOINT** must be used within a stored procedure.

Any committed statements within a stored procedure are controlled by the outermost transaction of the calling ODBC application. This means that, depending on the AUTOCOMMIT mode specified on SQLSetConnectOption, calling the stored procedure externally from an ODBC application performs one of two actions. It either commits automatically (AUTOCOMMIT on, the default) or waits for you to call SQLTransact with SQL_COMMIT or SQL_ROLLBACK (when AUTOCOMMIT is set to off).

Examples

The following example sets a **SAVEPOINT** then checks a condition to determine whether to **ROLLBACK** or to **RELEASE** the **SAVEPOINT**.

```
CREATE PROCEDURE Enroll_student( IN :student ubigint, IN
:classnum INTEGER);
BEGIN
   DECLARE  :CurrentEnrollment INTEGER;
   DECLARE  :MaxEnrollment INTEGER;
   SAVEPOINT SP1;
   INSERT INTO Enrolls VALUES (:student, :classnum,
      0.0);
   SELECT COUNT(*)  INTO  :CurrentEnrollment FROM
      Enrolls WHERE class_id = :classnum;
   SELECT  Max_size INTO  :MaxEnrollment FROM  Class
      WHERE  ID = :classnum;
```

```
    IF :CurrentEnrollment >= :MaxEnrollment
    THEN
    ROLLBACK TO SAVEPOINT SP1;
    ELSE
    RELEASE SAVEPOINT SP1;
    END IF;
END;
```

Note that COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

See Also

"CREATE PROCEDURE" on page 2-42

"ROLLBACK" on page 2-114

"SAVEPOINT" on page 2-115

RESTRICT

Remarks

If you specify **RESTRICT**, Pervasive.SQL enforces the **DELETE RESTRICT** rule. A user cannot delete a row in the parent table if a foreign key value refers to it.

If you do not specify a delete rule, Pervasive.SQL applies the **RESTRICT** rule by default.

See Also

"ALTER TABLE" on page 2-19

REVOKE

REVOKE deletes user IDs and removes permissions to specific users in a secured database.

Syntax

REVOKE CREATETAB FROM *public-or-user-group-name* [, *public-or-user-group-name*] . . .

REVOKE LOGIN FROM *user-name* [, *user-name*] . . .

REVOKE *table-privilege* **ON** *table-name*
FROM *user-or-group-name* [, *user-or-group-name*] . . .

table-privilege : : = **ALL**
| **SELECT** [(*column-name* [, *column-name*] . . .)]
| **UPDATE** [(*column-name* [, *column-name*] . . .)]
| **INSERT** [(*column-name* [, *column-name*] . . .)]
| **DELETE**
| **ALTER**
| **REFERENCES**

public-or-user-group-name : : = **PUBLIC** | *user-group-name*

user-group-name : : = *user-name* | *group-name*

group-name : : = *user-defined-name*

user-name : : = *user-defined-name*

Examples

The following statement revokes all these privileges from dannyd for table Class.

```
REVOKE ALL ON Class FROM 'dannyd'
```

The following statement revokes all privileges from dannyd and travisk for table Class.

```
REVOKE ALL ON Class FROM 'dannyd', travisk
```

▼ ▼ ▼

This statement revokes **DELETE** privileges from dannyd and travisk for table Class.

```
REVOKE DELETE ON Class FROM dannyd, travisk
```

▼ ▼ ▼

The following example revokes **INSERT** rights from keithv and miked for table Class.

```
REVOKE INSERT ON Class FROM keithv, miked
```

The following example revokes **INSERT** rights from keithv and brendanb for table Person and columns First_name and Last_name.

```
REVOKE INSERT(First_name,Last_name) ON Person FROM
keithv, brendanb
```

▼ ▼ ▼

The following statement revokes **ALTER** rights from dannyd from table Class.

```
REVOKE ALTER ON Class FROM dannyd
```

▼ ▼ ▼

The following example revokes **SELECT** rights from dannyd and travisk on table Class.

```
REVOKE SELECT ON Class FROM dannyd, travisk
```

The following statement revokes **SELECT** rights from dannyd and travisk in table Person for columns First_name and Last_name.

```
REVOKE SELECT(First_name, Last_name) ON Person FROM
dannyd, travisk
```

▼ ▼ ▼

The following example revokes **UPDATE** rights from dannyd and travisk for table Person.

```
REVOKE UPDATE ON Person ON dannyd, travisk
```

See Also

"GRANT" on page 2-80

ROLLBACK

ROLLBACK returns the database to the state it was in before the current transaction began. This statement releases the locks acquired since the last **SAVEPOINT** or **START TRANSACTION**.

Syntax

```
ROLLBACK [ WORK ] [ TO SAVEPOINT savepoint-name ]
```

Remarks

ROLLBACK, **SAVEPOINT**, and **RELEASE** are supported at the session level (outside of stored procedures) only if AUTOCOMMIT is off. Otherwise, **ROLLBACK**, **SAVEPOINT**, and **RELEASE** must be used within a stored procedure.

Any committed statements within a stored procedure are controlled by the outermost transaction of the calling ODBC application. This means that, depending on the AUTOCOMMIT mode specified on SQLSetConnectOption, calling the stored procedure externally from an ODBC application performs one of two actions. It either commits automatically (AUTOCOMMIT on, the default) or waits for you to call SQLTransact with SQL_COMMIT or SQL_ROLLBACK (when AUTOCOMMIT is set to off).

In the case of nested transactions, **ROLLBACK** rolls back to the nearest **START TRANSACTION**. For example, if transactions are nested five levels, then five **ROLLBACK** statements are needed to undo all of the transactions. A transaction is either committed or rolled back, but not both. That is, you cannot roll back a committed transaction.

Examples

The following statement undoes the changes made to the database since the beginning of a transaction.

```
ROLLBACK WORK
```

The following statement undoes the changes made to the database since the last savepoint.

```
ROLLBACK TO SAVEPOINT SP1
```

See Also

"COMMIT" on page 2-37

"RELEASE SAVEPOINT" on page 2-109

"SAVEPOINT" on page 2-115

SAVEPOINT

SAVEPOINT defines a point in a transaction to which you can roll back.

Syntax

`SAVEPOINT` *savepoint-name*

savepoint-name ::= *user-defined-name*

Remarks

ROLLBACK, **SAVEPOINT**, and **RELEASE** are supported at the session level (outside of stored procedures) only if AUTOCOMMIT is off. Otherwise, **ROLLBACK**, **SAVEPOINT**, and **RELEASE** must be used within a stored procedure.

Any committed statements within a stored procedure are controlled by the outermost transaction of the calling ODBC application. This means that, depending on the AUTOCOMMIT mode specified on SQLSetConnectOption, calling the stored procedure externally from an ODBC application performs one of two actions. It either commits automatically (AUTOCOMMIT on, the default) or waits for you to call SQLTransact with SQL_COMMIT or SQL_ROLLBACK (when AUTOCOMMIT is set to off).

A **SAVEPOINT** applies only to the procedure in which it is defined. That is, you cannot reference a **SAVEPOINT** defined in another procedure.

Examples

The following example sets a **SAVEPOINT** then checks a condition to determine whether to **ROLLBACK** or to **RELEASE** the **SAVEPOINT**.

```
CREATE PROCEDURE Enroll_student( IN :student ubigint, IN
:classnum INTEGER);
BEGIN
    DECLARE  :CurrentEnrollment INTEGER;
    DECLARE  :MaxEnrollment INTEGER;
    SAVEPOINT SP1;
    INSERT INTO Enrolls VALUES (:student, :classnum,
        0.0);
    SELECT COUNT(*)  INTO  :CurrentEnrollment FROM
        Enrolls WHERE class_id = :classnum;
    SELECT  Max_size INTO  :MaxEnrollment FROM  Class
        WHERE  ID = :classnum;
    IF :CurrentEnrollment >= :MaxEnrollment
```

```
    THEN
    ROLLBACK TO SAVEPOINT SP1;
    ELSE
    RELEASE SAVEPOINT SP1;
    END IF;
END;
```

Note that COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

See Also

"COMMIT" on page 2-37

"CREATE PROCEDURE" on page 2-42

"RELEASE SAVEPOINT" on page 2-109

"ROLLBACK" on page 2-114

SELECT (with into)

The **SELECT** (with **INTO**) statement allows you to select column values from a specified table to insert into variable names within stored procedures.

Syntax

SELECT [**ALL** | **DISTINCT**] *select-list* **INTO** *variable-name* [, *variable-name*] . . .
FROM *table-reference* [, *table-reference*] . . . [**WHERE** *search-condition*]
[**GROUP BY** *expression* [, *expression*] . . . [**HAVING** *search-condition*]]

Remarks

The **SELECT** with the **INTO** clause is only allowed within stored procedures.

Examples

The following example assigns into variables :x, :y the values of first_name an last_name in the Person table where first name is Bill.

```
SELECT  first_name, last_name INTO :x, :y FROM person
WHERE first_name = 'Bill'
```

See Also

"CREATE PROCEDURE" on page 2-42

SELECT

Retrieves specified information from a database. A SELECT statement creates a temporary view.

Syntax

```
query-specification [ [ UNION [ ALL ] query-specification ] . . .
[ ORDER BY order-by-expression [ , order-by-expression ] . . . ]

order-by-expression ::= expression [ CASE | COLLATE collation-name ] [
    ASC | DESC ]

query-specification ::= ( query-specification )
    | SELECT [ ALL | DISTINCT ] select-list
      FROM table-reference [ , table-reference ] . . .
      [ WHERE search-condition ]
      [ GROUP BY expression [ , expression ] . . .
       [ HAVING search-condition ] ]

select-list ::= * | select-item [ , select-item ] . . .

select-item ::= expression [ [ AS ] alias-name ] | table-name . *

table-reference ::= { OJ outer-join-definition }
    | table-name [ [ AS ] alias-name ]
    | join-definition
    | ( join-definition )

join-definition ::= table-reference [ INNER ] JOIN table-reference ON search-
    condition
    | table-reference CROSS JOIN table-reference
    | outer-join-definition

outer-join-definition ::= table-reference outer-join-type JOIN table-reference
ON search-condition

outer-join-type ::= LEFT [ OUTER ] | RIGHT [ OUTER ] | FULL
    [ OUTER ]

search-condition ::= search-condition AND search-condition
    | search-condition OR search-condition
    | NOT search-condition
    | ( search-condition )
    | predicate
```

predicate ::= *expression* [**NOT**] **BETWEEN** *expression* **AND** *expression*
| *expression comparison-operator expression-or-subquery*
| *expression* [**NOT**] **IN** (*query-specification*)
| *expression* [**NOT**] **IN** (*value* [, *value*] . . .)
| *expression* [**NOT**] **LIKE** *value*
| *expression* **IS** [**NOT**] **NULL**
| *expression comparison-operator* **ANY** (*query-specification*)
| *expression comparison-operator* **ALL** (*query-specification*)
| *expression comparison-operator* **SOME** (*query-specification*)
| **EXISTS** (*query-specification*)

comparison-operator ::= < | > | <= | >= | = | <>

expression-or-subquery ::= *expression* | (*query-specification*)

value ::= *literal* | **USER** | ?

expression ::= *expression* - *expression*
| *expression* + *expression*
| *expression* * *expression*
| *expression* / *expression*
| (*expression*)
| -*expression*
| +*expression*
| *column-name*
| ?
| *literal*
| *set-function*
| *scalar-function*
| { *fn scalar-function* }
| **USER**
| **IF** (*search-condition* , *expression* , *expression*)
| **SQLSTATE**
| : *user-defined-name*
| **@:IDENTITY**
| **@:ROWCOUNT**
| **@@IDENTITY**
| **@@ROWCOUNT**

```
set-function ::= COUNT (*)
    | COUNT ( [ DISTINCT | ALL ] expression )
    | SUM ( [ DISTINCT | ALL ] expression )
    | AVG ( [ DISTINCT | ALL ] expression )
    | MIN ( [ DISTINCT | ALL ] expression )
    | MAX ( [ DISTINCT | ALL ] expression )

scalar-function ::= see "Scalar Functions" on page 2-156
```

Remarks

In addition to supporting a **GROUP BY** on a column-list, as specified in the *Microsoft ODBC Programmer's Reference*, Pervasive ODBC Engine Interface has extended the syntax to support a **GROUP BY** on an expression-list or on any expression in a **GROUP BY** expression-list. See "GROUP BY" on page 2-85 for more information on **GROUP BY** extensions. **HAVING** is not supported without **GROUP BY.**

Result sets and stored views generated by executing **SELECT** statements with any of the following characteristics are read-only (they cannot be updated). That is, a positioned UPDATE, a positioned DELETE and an SQLSetPos call to add, alter or delete data is no allowed on the result set or stored view:

- SQL_CONCUR_READ_ONLY was specified as the SQL_CONCURRENCY type via SQLSetStmtOption
- The selection-list contains an aggregate:
  `SELECT SUM(c1) FROM t1`
- The selection-list specifies DISTINCT:
  `SELECT DISTINCT c1 FROM t1`
- The view contains a GROUP BY clause:
  `SELECT SUM(c1), c2 FROM t1 GROUP BY c2`
- The view is a join (references multiple tables):
  `SELECT * FROM t1, t2`
- The view uses the UNION operator and UNION ALL is not specified or all SELECT statements do not reference the same table:
  `SELECT c1 FROM t1 UNION SELECT c1 FROM t1`
  `SELECT c1 FROM t1 UNION ALL SELECT c1 FROM t2`
    - Note that stored views do not allow the UNION operator.

- The view contains a subquery that references a table other than the table in the outer query:

  ```
  SELECT c1 FROM t1 WHERE c1 IN (SELECT c1 FROM t2)
  ```

Examples

This simple **SELECT** statement retrieves all the data from the Faculty table.

```
SELECT * FROM Faculty
```

This statement retrieves the data from the person and the faculty table where the id column in the person table is the same as the id column in the faculty table.

```
SELECT Person.id, Faculty.salary FROM Person, Faculty
WHERE Person.id = Faculty.id
```

▼▼▼

The following example retrieves student_id and sum of the amount_paid where it is greater than or equal to 100 from the billing table. It then groups the records by student_id.

```
SELECT Student_ID, SUM(Amount_Paid)
   FROM Billing
   GROUP BY Student_ID
   HAVING SUM(Amount_Paid) >=100.00
```

If the expression is a positive integer literal, then that literal is interpreted as the number of the column in the result set and ordering is done on that column. No ordering is allowed on set functions or an expression that contains a set function.

Subqueries

The following types of subqueries are supported: comparison, quantified, in, exists, and correlated. **ORDER BY** clauses are not allowed in a subquery clause.

Correlated subquery predicates in the **HAVING** clause which contain references to grouped columns are not supported.

approximate-numeric-literal

Examples

```
SELECT * FROM results WHERE quotient =-4.5E-2
   INSERT INTO results (quotient) VALUES (+5E7)
```

between-predicate

Remarks

The syntax expression1 BETWEEN expression2 and expression3 returns TRUE if expression1 >= expression2 and expression1<= expression3. FALSE is returned if expression1 >= expression3, or is expression1 <= expression2.

Expression2 and expression3 may be dynamic parameters (for example, `SELECT * FROM emp WHERE emp_id BETWEEN ? AND ?)`

Examples

The next example retrieves the first names from the person table whose ID fall between 10000 and 20000.

```
SELECT First_name FROM Person WHERE ID BETWEEN 10000 AND
20000
```

correlation-name

Remarks

Both table and column correlation names are supported.

Examples

The following example selects data from both the person table and the faculty table using the aliases T1 and T2 to differentiate between the two tables.

```
SELECT * FROM Person T1, Faculty T2 WHERE T1.id = T2.id
```

The correlation name for a table name can also be specified in using the FROM clause, as seen in the following example.

```
SELECT a.Name, b.Capacity FROM Class a, Room b
   WHERE a.Room_Number = b.Number
```

exact-numeric-literal

Examples

```
SELECT car_num, price FROM cars WHERE car_num =49042 AND
price=49999.99
```

in-predicate

Examples

This selects the records from table Person table where the first names are Bill and Roosevelt.

```
SELECT * FROM  Person WHERE  First_name IN ('Roosevelt',
'Bill')
```

set-function

Examples

The following example selects the minimum salary from the Faculty table.

```
SELECT MIN(salary) FROM Faculty
```

MIN(expression), MAX(expression), SUM(expression), AVG(expression), COUNT(*), and COUNT(expression) are supported.

COUNT(expression) counts all non-NULL values for an expression across a predicate. COUNT(*) counts all values, including NULL values.

The following example counts all the rows in q where a+b does not equal **NULL**.

```
SELECT COUNT(a+b) FROM q
```

date-literal

Remarks

Date constants may be expressed in SQL statements as a character string or embedded in a vendor string. `SQL_CHAR` and the vendor string representation are treated as a value of type `SQL_DATE`. This becomes important when conversions are attempted.

The Pervasive ODBC Engine Interface partially supports extended SQL grammar, as outlined in this function.

Examples

The next two statements return all the classes whose start date is after 1995-06-05.

```
SELECT * FROM Class WHERE Start_Date > '1995-06-05'

SELECT * FROM Class WHERE Start_Date > {d '1995-06-05'}
```

The Pervasive ODBC Engine Interface supports the following date literal format: 'YYYY-MM-DD'.

Dates may be in the range of year 0 to 9999.

time-literal

Examples

The following two statements retrieve records from the class table where the start time for the classes is 14:00:00.

```
SELECT * FROM Class WHERE Start_time = '14:00:00'
```

```
SELECT * FROM Class WHERE Start_time = {t '14:00:00'}
```

The Pervasive ODBC Engine Interface supports the following time literal format: 'HH:MM:SS'.

Time constants may be expressed in SQL statements as a character string or embedded in a vendor string. Character string representation is treated as a string of type `SQL_CHAR` and the vendor string representation as a value of type `SQL_TIME`.

The Pervasive ODBC Engine Interface partially supports extended SQL grammar, as outlined in this function.

timestamp-literal

Remarks

Timestamp constants may be expressed in SQL statements as a character string or embedded in a vendor string. The Pervasive ODBC Engine Interface treats the character string representation as a string of type `SQL_CHAR` and the vendor string representation as a value of type `SQL_TIMESTAMP`. The Pervasive ODBC Engine Interface partially supports extended SQL grammar, as outlined in this function.

Examples

The next two statements retrieve records from the Billing table where the start day and time for the log is 1996-03-28 at 17:40:49.

```
SELECT * FROM Billing WHERE log = '1996-03-28 17:40:49'
```

```
SELECT * FROM Billing WHERE log = {ts '1996-03-28
17:40:49'}
```

The Pervasive ODBC Engine Interface supports the following time literal format: 'YYYY-MM-DD HH:MM:SS'

date arithmetic

Examples

```
SELECT * FROM person P, Class C WHERE p.Date_Of_Birth <
' 1973-09-05' AND c.Start_date >{d '1995-05-08'} + 30
```

The Pervasive ODBC Engine Interface supports adding or subtracting an integer from a date where the integer is the number of days to add or subtract, and the date is embedded in a vendor string. (This is equivalent to executing a convert on the date).

The Pervasive ODBC Engine Interface also supports subtracting one date from another to yield a number of days.

IF

Remarks

The IF system scalar function provides conditional execution based on the truth value of a condition

Examples

This expression prints the column header as “Prime1” and amount owed as 2000 where the value of the column amount_owed is 2000 or it prints a 0 if the value of the amount_owed column is not equal to 2000.

```
SELECT Student_ID, Amount_Owed,
   IF (Amount_Owed = 2000, Amount_Owed, Convert(0,
      SQL_DECIMAL)) "Prime1"
   FROM Billing
```

From table Class, the following example prints the value in the Section column if the section is equal to 001, else it prints “xxx” under column header Prime1

Under column header Prime2, it prints the value in the Section column if the value of the section column is equal to 002, or else it prints “yyy.”

```
SELECT ID, Name, Section,
   IF (Section = '001', Section, 'xxx') "Prime1",
   IF (Section = '002', Section, 'yyy') "Prime2"
FROM Class
```

You can combine header Prime1 and header Prime2 by using nested IF functions. Under column header Prime, the following query prints the value of the Section column if the value of the Section column is equal to 001 or 002. Otherwise, it print “xxx.”

```
SELECT ID, Name, Section,
   IF (Section = '001', Section, IF(Section = '002',
      Section, 'xxx')) Prime
FROM Class
```

left outer join

Remarks

The following example shows how to access the “Person” and “Student” tables from the DEMODATA database to obtain the Last Name, First Initial of the First Name and GPA of students. With the LEFT OUTER JOIN, all rows in the “Person” table are fetched (the table to the left of LEFT OUTER JOIN). Since not all people have GPA’s, some of the columns have NULL values for the results. This is how outer join works, returning non-matching rows from either table.

Examples

```
SELECT Last_Name,Left(First_Name,1) AS
First_Initial,Cumulative_GPA AS GPA FROM "Person"
   LEFT OUTER JOIN "Student" ON Person.ID=Student.ID
   ORDER BY Cumulative_GPA DESC, Last_Name
```

Assume that you want to know everyone with perfectly rounded GPA’s and have them all ordered by the length of their last name. Using the MOD statement and the LENGTH scalar function, you can achieve this by adding the following to the query:

```
   WHERE MOD(Cumulative_GPA,1)=0 ORDER BY
      LENGTH(Last_Name)
```

right outer join

Remarks

The difference between LEFT and RIGHT OUTER JOIN is that all non matching rows show up for the table defined to the right of RIGHT OUTER JOIN. Change the query for LEFT OUTER JOIN to include a RIGHT OUTER JOIN instead. The difference is that the all non-matching rows from the right table, in this case “Student,” show up even if no GPA is present. However, since all rows in the “Student” table have GPA’s, all rows are fetched.

Examples

```
SELECT Last_Name,Left(First_Name,1) AS
First_Initial,Cumulative_GPA AS GPA FROM "Person"
    RIGHT OUTER JOIN "Student" ON Person.ID=Student.ID
    ORDER BY Cumulative_GPA DESC, Last_Name
```

Cartesian join

Remarks

A Cartesian join is the matrix of all possible combinations of the rows from each of the tables. The number of rows in the Cartesian product equals the number of rows in the first table times the number of rows in the second table.

Examples

Assume you have the following tables in your database:

Table 2-15 Addr Table

EmpID	Street
E1	101 Mem Lane
E2	14 Young St.

Table 2-16 Loc Table

LocID	Name
L1	PlanetX
L2	PlanetY

The following performs a Cartesian JOIN on these tables:

```
SELECT * FROM Addr,Loc
```

This results in the following:

Table 2-17 SELECT Statement with Cartesian JOIN

EmpID	Street	LocID	Name
E1	101 Mem Lane	L1	PlanetX
E1	101 Mem Lane	L2	PlanetY
E2	14 Young St	L1	PlanetX
E2	14 Young St	L2	PlanetY

DISTINCT

Remarks

You can use **DISTINCT** with SUM, AVG, COUNT, MIN, and MAX (but it does not change results with MIN and MAX). **DISTINCT** eliminates duplicate values before calculating the sum, average or count.

Examples

Suppose you want to know the salaries for different departments including the minimum, maximum and salary, and you want to remove duplicate salaries. The following statement would do this, excluding the computer science department:

```
SELECT dept_name, MIN(salary), MAX(salary), AVG(DISTINCT
salary) FROM faculty WHERE dept_name<>'computer_science'
GROUP BY dept_name
```

If you wanted to include duplicate salaries, you would use:

```
SELECT dept_name, MIN(salary), MAX(salary), AVG(salary)
FROM faculty WHERE dept_name<>'computer_science' GROUP
BY dept_name
```

See Also

"Global Variables" on page 2-13

"JOIN" on page 2-94

SET SECURITY

The **SET SECURITY** statement allows you to enable and disable security for the database to which you are currently logged in.

Syntax

```
SET SECURITY = password
SET SECURITY = NULL
```

Examples

The following example sets the password as 'password'.

```
SET SECURITY = 'password'
```

The following example sets the password as 123456.

```
SET SECURITY = '123456'
```

▾ ▾ ▾

The following example disables security.

```
SET SECURITY = NULL
```

Remarks

You must be logged in as Master to set security. You can then assign a password by using the **SET SECURITY** statement. There is no password required to log in as Master initially.

When using **SET SECURITY**, user name and password are case sensitive.

Only one Master user connection to the database is allowed to set security. You can set security from the Pervasive Control Center (PCC).

> **Note** The SET SECURITY statement cannot be executed within the SQL Data Manager. An error results if you try. For a database with no security, the SQL Data Manager locks the dictionary files, which prevents you from setting the password. For a secure database, the SQL Data Manager opens a second connection to the database files, which prevents you from disabling security.

See Also

"GRANT" on page 2-80

"REVOKE" on page 2-112

SET TRUENULLCREATE

The **SET TRUENULLCREATE** statement turns on or off true NULLs when you create new tables.

Syntax

```
SET TRUENULLCREATE = < ON | OFF >
```

Remarks

Pervasive.SQL 2000i allows you to set the default format for creation of tables with regard to NULL support. Normally, the product creates new tables using the true NULL data record format, which adds a NULL indicator byte to the beginning of every field. By turning off this engine setting using an SQL statement, you can create new tables that use the legacy NULL data record format that was used in Pervasive.SQL 7.

The creation mode remains in effect until it is changed by issuing the statement again, or until the connection is disconnected. Because this setting is maintained on a per-connection basis, separate database connections can maintain different creation modes, even within the same application. Every connection starts with the setting in default mode, where new tables are created with true NULL support.

This feature does not affect existing tables or available column data types. All tables are created using Pervasive.SQL data types. For example, old data types such as NOTE or LVAR are not available for use regardless of which type of NULL support is selected.

Also see the discussion about nullable data types under “INSERT” on page 2-90.

This setting can only be toggled using SQL, it cannot be set using the Pervasive Control Center (PCC).

Examples

To toggle the setting and specify that new tables should be created with legacy NULL support, use this SQL statement:

```
SET TRUENULLCREATE=OFF
```

To toggle the setting and return the engine to the default, which is table creation with true NULL support, use this SQL statement:

```
SET TRUENULLCREATE=ON
```

SET VARIABLE

SET assigns a value to a declared variable.

Syntax

SET *variable-name* = *proc-expr*

Remarks

You must declare variables before you can set them. **SET** is allowed only in stored procedures and triggers.

Examples

The following examples assigns a value of 10 to var1.

```
SET:var1 = 10;
```

See Also

"CREATE PROCEDURE" on page 2-42

"DECLARE" on page 2-64

SIGNAL

Remarks

The **SIGNAL** statement allows you to signal an exception condition or a completion condition other than successful completion.

Signalling an **SQLSTATE** value causes **SQLSTATE** to be set to a specific value. This value is then returned to the user, or made available to the calling procedure (through the **SQLSTATE** value). This value is available to the application calling the procedure.

SIGNAL is available only inside a stored procedure.

Examples

The following example prints the initial SQLSTATE value "00000," then prints "SQLSTATE exception caught" after the signal is raised. The final SQLSTATE value printed is "W9001."

```
CREATE PROCEDURE GenerateSignal();
BEGIN
    SIGNAL 'W9001';
END;

CREATE PROCEDURE TestSignal() WITH DEFAULT HANDLER;
BEGIN
    PRINT SQLSTATE;
    CALL GenerateSignal();
    IF SQLSTATE <> '00000' THEN
        PRINT 'SQLSTATE exception caught';
    END IF;
    PRINT SQLSTATE;
END;
```

See Also

"CREATE PROCEDURE" on page 2-42

SQLSTATE

Remarks

The **SQLSTATE** value corresponds to a success, warning, or exception condition. The complete list of **SQLSTATE** values defined by ODBC can be found in the Microsoft ODBC SDK documentation.

When a handler executes, the statements within it affect the **SQLSTATE** value in the same way as statements in the main body of the compound statement. However, a handler that is intended to take specific action for a specific condition can optionally leave that condition unaffected, by re-assigning that condition at its conclusion. This does not cause the handler to be invoked again; that would cause a loop. Instead, Pervasive.SQL treats the exception condition as an unhandled exception condition, and execution stops.

See Also

"CREATE PROCEDURE" on page 2-42

"SELECT" on page 2-118

"SIGNAL" on page 2-132

START TRANSACTION

START TRANSACTION signals the start of a logical transaction. **START TRANSACTION** must always be paired with a **COMMIT** or a **ROLLBACK**.

Syntax

```
START TRANSACTION
```

Remarks

START TRANSACTION is supported only within stored procedures. You cannot use **START TRANSACTION** within the SQL Data Manager. (The SQL Data Manager sets AUTOCOMMIT to "on.")

Examples

The following example, within a stored procedure, begins a transaction which updates the Amount_Owed column in the Billing table. This work is committed; another transaction updates the Amount_Paid column and sets it to zero. The final **COMMIT WORK** statement ends the second transaction.

Statements are delimited with a semi-colon inside stored procedures and triggers.

```
START TRANSACTION;
UPDATE Billing B
    SET Amount_Owed = Amount_Owed - Amount_Paid
    WHERE Student_ID IN
        (SELECT DISTINCT E.Student_ID
        FROM Enrolls E, Billing B
        WHERE E.Student_ID = B.Student_ID);
COMMIT WORK;
START TRANSACTION;
UPDATE Billing B
    SET Amount_Paid = 0
    WHERE Student_ID IN
        (SELECT DISTINCT E.Student_ID
        FROM Enrolls E, Billing B
        WHERE E.Student_ID = B.Student_ID);
COMMIT WORK;
```

See Also

"COMMIT" on page 2-37

"CREATE PROCEDURE" on page 2-42

"ROLLBACK" on page 2-114

UNION

Remarks

SELECT statements that use **UNION** or **UNION ALL** allow you to obtain a single result table from multiple **SELECT** queries. **UNION** queries are suitable for combining similar information contained in more than one data source.

UNION eliminates duplicate rows. **UNION ALL** preserves duplicate rows. Using the **UNION ALL** option is recommended unless you require duplicate rows to be removed.

With **UNION**, the Pervasive.SQL Engine orders the entire result set which, for large tables, can take several minutes. **UNION ALL** eliminates the need for the sort.

The Pervasive.SQL Engine does not support **LONGVARBINARY** columns in **UNION** statements. **LONGVARCHAR** is limited to 65500 bytes in **UNION** statements. The operator **UNION** cannot be applied to any SQL statement that references one or more views.

The two query specifications involved in a union must be compatible. Each query must have the same number of columns and the columns must be of compatible data types.

Examples

The following example lists the ID numbers of each student whose last name begins with 'M' or who has a 4.0 grade point average. The result table does not include duplicate rows.

```
SELECT Person.ID FROM Person WHERE Last_name LIKE  'M%'
UNION SELECT Student.ID FROM Student WHERE
Cumulative_GPA = 4.0
```

The next example lists the column id in the person table and the faculty table including duplicate rows.

```
SELECT person.id FROM person UNION ALL SELECT faculty.id
from faculty
```

The next example lists the ID numbers of each student whose last name begins with 'M' or who has a 4.0 grade point average. The result table does not include duplicate rows and orders the result set by the first column

```
SELECT Person.ID FROM Person WHERE Last_name LIKE  'M%'
UNION SELECT Student.ID FROM Student WHERE
Cumulative_GPA = 4.0 ORDER BY 1
```

It is common to use the **NULL** scalar function to allow a **UNION** select list to have a different number of entries than the parent select list. To do this, you must use the **CONVERT** function to force the **NULL** to the correct type.

```
CREATE TABLE t1 (c1 INTEGER, c2 INTEGER)
    INSERT INTO t1 VALUES (1,1)
CREATE TABLE t2 (c1 INTEGER)
    INSERT INTO t2 VALUES (2)
SELECT c1, c2 FROM t1
UNION SELECT c1, CONVERT(NULL(),sql_integer)FROM t2
```

See Also

"SELECT" on page 2-118

UNIQUE

Remarks

To specify that the index not allow duplicate values, include the **UNIQUE** keyword. If the column or columns that make up the index contains duplicate values when you execute the **CREATE INDEX** statement with the **UNIQUE** keyword, Pervasive.SQL returns Status Code 5 and does not create the index.

Note You should not include the **UNIQUE** keyword in the list of index attributes following the column name you specify; the preferred syntax is **CREATE UNIQUE INDEX**.

See Also

"ALTER TABLE" on page 2-19

"CREATE INDEX" on page 2-40

"CREATE TABLE" on page 2-50

UPDATE

The **UPDATE** statement allows you to modify column values in a database.

Syntax

UPDATE *table-name* [*alias-name*]
  SET *column-name* = < *expression* | *subquery* >
  [, *column-name* = < *expression* | *subquery* >] . . .
  [**WHERE** *search-condition*]

Remarks

INSERT, **UPDATE**, and **DELETE** statements behave in an atomic manner. That is, if an insert, update, or delete of more than one row fails, then all insertions, updates, or deletes of previous rows by the same statement are rolled back.

In the **SET** clause of an **UPDATE** statement, you may specify a subquery. This feature allows you to update information in a table based on information in another table or another part of the same table.

The **UPDATE** statement can update only a single table at a time. **UPDATE** can relate to other tables via a subquery in the **SET** clause. This can be a *correlated* subquery that depends in part on the contents of the table being updated, or it can be a *non-correlated* subquery that depends only on another table.

Correlated Subquery

```
UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2 WHERE T2.C1
= T1.C1)
```

Non-correlated Subquery

```
UPDATE T1 SET T1.C2 = (SELECT SUM(T2.C2) FROM T2 WHERE
T2.C1 = 10)
```

The same logic is used to process pure **SELECT** statements and subqueries, so the subquery can consist of any valid **SELECT** statement. There are no special rules for subqueries.

If **SELECT** within an **UPDATE** returns no rows, then the **UPDATE** inserts NULL. If the given column(s) is/are not nullable, then the **UPDATE** fails. If select returns more than one row, then **UPDATE** fails.

An **UPDATE** statement does not allow the use of join tables in the statement. Instead, use a correlated subquery in the **SET** clause as follows:

```
UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2 WHERE T2.C1
= T1.C1)
```

All data types for data created prior to Pervasive.SQL 2000 (legacy data) report back as nullable. This means that you can UPDATE NULL into any legacy column type without pseudo-NULL conversion. The following data types are treated as pseudo-NULL by default:

Date	Decimal	Money	Numeric
NumericSA	NumericSTS	Timestamp	

(Normally, when you convert a legacy column to pseudo-NULL, you lose one of the binary values, forfeiting it so that you can query the column for NULL. These data types, however, because of their design, have a different, unique internal value for NULL in addition to their normal data range. With these data types, no binary values are lost if they are converted to NULL so there is no harm considering them as pseudo-NULL by default.)

The rest of the data types are considered “legacy nullable,” meaning that NULL may be updated into them. When values are queried, however, the non-NULL binary equivalent is returned. This same binary equivalent must be used in WHERE clauses to retrieve specific values.

The binary equivalents are:

- 0 for Binary types
- Empty string from string and BLOB types (legacy types LVAR and NOTE)

Examples

The following examples updates the record in the faculty table and sets salary as 95000 for ID 103657107.

```
UPDATE Faculty SET salary = 95000.00 WHERE ID = 103657107
```

The following example changes the credit hours for Economics 305 in the course table from 3 to 4.

```
UPDATE Course SET Credit_Hours = 4 WHERE Name = 'ECO 305'
```

The following example updates the address for a person in the Person table:

```
UPDATE Person p
   SET p.Street = '123 Lamar',
   p.zip = '78758',
   p.phone = 5123334444
   WHERE p.ID = 131542520
```

Subquery Example A

Two tables are created and rows are inserted. The first table, t5, is updated with a column value from the second table, t6, in each row where table t5 has the value 2 for column c1. Because there is more than one row in table t6 containing a value of 3 for column c2, the first UPDATE fails because more than one row is returned by the subquery. This result occurs even though the result value is the same in both cases. As shown in the second **UPDATE**, using the **DISTINCT** keyword in the subquery eliminates the duplicate results and allows the statement to succeed.

```
CREATE TABLE t5 (c1 INT, c2 INT)
CREATE TABLE t6 (c1 INT, c2 INT)
INSERT INTO t5(c1, c2) VALUES (1,3)
INSERT INTO t5(c1, c2) VALUES (2,4)

INSERT INTO t6(c1, c2) VALUES (2,3)
INSERT INTO t6(c1, c2) VALUES (1,2)
INSERT INTO t6(c1, c2) VALUES (3,3)
SELECT * FROM t5
```

Results:

```
c1         c2
---------- -----
1          3
2          4
```

```
UPDATE t5 SET t5.c1=(SELECT c2 FROM t6 WHERE c2=3) WHERE
   t5.c1=2 — Note that the query fails

UPDATE t5 SET t5.c1=(SELECT DISTINCT c2 FROM t6 WHERE
   c2=3) WHERE t5.c1=2 — Note that the query succeeds
```

```
SELECT * FROM t5
```

Results:

```
c1         c2
---------- -----
1          3
3          4
```

Subquery Example B

Two tables are created and a variety of valid syntax examples are demonstrated. Note the cases where **UPDATE** fails because the subquery returns more than one row. Also note that **UPDATE** succeeds and NULL is inserted if the subquery returns no rows (where NULL values are allowed).

```
CREATE TABLE T1 (C1 INT, C2 INT)
CREATE TABLE T2 (C1 INT, C2 INT)

INSERT INTO T1 VALUES (1, 0)
INSERT INTO T1 VALUES (2, 0)
INSERT INTO T1 VALUES (3, 0)
INSERT INTO T2 VALUES (1, 100)
INSERT INTO T2 VALUES (2, 200)

UPDATE T1 SET T1.C2 = (SELECT SUM(T2.C2) FROM T2)
UPDATE T1 SET T1.C2 = 0
UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2 WHERE T2.C1
    = T1.C1)

UPDATE T1 SET T1.C2 = @@IDENTITY
UPDATE T1 SET T1.C2 = @@ROWCOUNT
UPDATE T1 SET T1.C2 = (SELECT @@IDENTITY)
UPDATE T1 SET T1.C2 = (SELECT @@ROWCOUNT)

UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2) — update fails
INSERT INTO T2 VALUES (1, 150)
INSERT INTO T2 VALUES (2, 250)
UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2 WHERE T2.C1
    = T1.C1) — update fails
UPDATE T1 SET T1.C2 = (SELECT T2.C2 FROM T2 WHERE T2.C1
    = 5) — Note that the update succeeds, NULL is inserted for all rows of T1.C2
UPDATE T1 SET T1.C2 = (SELECT SUM(T2.C2) FROM T2 WHERE
    T2.C1 = T1.C1)
```

See Also

"ALTER TABLE" on page 2-19

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

"GRANT" on page 2-80

UPDATE (positioned)

The positioned **UPDATE** statement updates the current row of a rowset associated with an SQL cursor.

Syntax

UPDATE [*table-name*] **SET** *column-name* = *proc-expr* [, *column-name* = *proc-expr*] . . .

WHERE CURRENT OF *cursor-name*

Remarks

This statement is allowed in stored procedures, triggers, and at the session level.

Note Even though positioned **UPDATE** is allowed at the session level, the DECLARE CURSOR statement is not. Use the SQLGetCursorName() API to obtain the cursor name of the active result set.

The *table-name* may be specified in the positioned **UPDATE** statement only when used at the session level. *Table-name* cannot be specified with a stored procedure or trigger.

Examples

The following sequence of statements provide the setting for the positioned **UPDATE** statement. The required statements for a positioned **UPDATE** are **DECLARE CURSOR, OPEN CURSOR,** and **FETCH FROM** *cursorname*.

The positioned **UPDATE** statement in this example updates the name of the course HIS 305 to HIS 306.

```
CREATE PROCEDURE UpdateClass();

BEGIN[ alias-name ] [ alias-name ]

    DECLARE  :CourseName CHAR(7);

    DECLARE  :OldName CHAR(7);

    DECLARE  c1 CURSOR FOR SELECT name FROM course WHERE
        name = :CourseName;

    OPEN c1;

    SET  :CourseName  = 'HIS 305';

    FETCH NEXT FROM c1 INTO :OldName;

    UPDATE SET name = 'HIS 306'   WHERE CURRENT OF c1;
END;
```

See Also

"CREATE PROCEDURE" on page 2-42
"CREATE TRIGGER" on page 2-59

WHILE

Use a **WHILE** statement is used to control flow. It allows code to be executed repeatedly as long as a certain condition is true.

Syntax

[*label-name* :] **WHILE** *proc-search-condition*
  DO [*proc-stmt* [; *proc-stmt*]]... **END WHILE** [*label-name*]

Remarks

A **WHILE** statement can have a beginning label (the statement is referred to as a labeled **WHILE** statement).

Examples

The following example increments the variable vInteger by 1 until it reaches a value of 10, when the loop ends.

```
WHILE (:vInteger < 10) DO
    SET :vInteger = vInteger + 1;
END WHILE
```

See Also

"CREATE PROCEDURE" on page 2-42

"CREATE TRIGGER" on page 2-59

Grammar Element Definitions

The following is an alphabetical summary of the element definitions used in the grammar syntax section:

alter-option-list ::=*alter-option*

| (*alter-option* [, *alter-option*} . . .)

alter-option ::= **ADD** [**COLUMN**] *column-definition*

| **ADD** *table-constraint-definition*

| **DROP** [**COLUMN**] *column-name*

| **DROP CONSTRAINT** *constraint-name*

| **DROP PRIMARY KEY**

as-or-semicolon ::= **AS** | ;

before-or-after ::= **BEFORE** | **AFTER**

call-arguments ::= *positional-argument* [, *positional-argument*] . . .

col-constraint ::= **NOT NULL**

| **UNIQUE**

| **PRIMARY KEY**

| **REFERENCES** *table-name* [(*column-name*)] [*referential-actions*]

collation-name ::= '*string*' | *user-defined-name*

column-constraint ::= [**CONSTRAINT** *constraint-name*] *col-constraint*

column-definition ::= *column-name data-type* [**DEFAULT** *default-value*] [*column-constraint* [*column-constraint*] . . . [**CASE** | **COLLATE** *collation-name*]

column-name ::= *user-defined-name*

commit-statement ::= see **COMMIT** statement

comparison-operator ::= < | > | <= | >= | = | <>

constraint-name ::= *user-defined-name*

correlation-name ::= *user-defined-name*

cursor-name ::= *user-defined-name*

data-type ::= *data-type-name* [(*precision* [, *scale*])] *data-type-name* ::= see list in Appendix A

default-value ::= *literal*

expression ::= *expression* - *expression*

| *expression* + *expression*
| *expression* * *expression*
| *expression* / *expression*
| (*expression*)
| -*expression*
| +*expression*
| *column-name*
| ?
| *literal*
| *set-function*
| *scalar-function*
| { *fn scalar-function* }
| **USER**
| **IF** (*search-condition* , *expression* , *expression*)
| **SQLSTATE**
| : *user-defined-name*

expression-or-subquery ::= *expression* | (*query-specification*)

fetch-orientation ::= | **NEXT**

group-name ::= *user-defined-name*

index-definition ::= (*index-segment-definition* [, *index-segment-definition*] ...)

index-segment-definition ::= *column-name* [**ASC** | **DESC**]

index-name ::= *user-defined-name*

ins-upd-del ::= **INSERT** | **UPDATE** | **DELETE**

insert-values ::= *values-clause*

| *query-specification*

join-definition ::= *table-reference* [**INNER**] **JOIN** *table-reference* **ON** *search-condition*
| *table-reference* **CROSS JOIN** *table-reference*
| *outer-join-definition*

label-name ::= *user-defined-name*

literal ::= 'string'
| number
| { d 'date-literal' }
| { t 'time-literal' }
| { ts 'timestamp-literal' }

order-by-expression ::= *expression* [**CASE** | **COLLATE** *collation-name*] [**ASC** | **DESC**]

outer-join-definition ::= *table-reference outer-join-type* **JOIN** *table-reference* **ON** *search-condition*

outer-join-type ::= **LEFT** [**OUTER**] | **RIGHT** [**OUTER**] | **FULL** [**OUTER**]

parameter ::= *parameter-type-name data-type* [**DEFAULT** *proc-expr* | = *proc-expr*]
| **SQLSTATE**

parameter-type-name ::= parameter-name
| *parameter-type parameter-name*
| *parameter-name parameter-type*

parameter-type ::= **IN** | **OUT** | **INOUT** | **IN_OUT**

parameter-name ::= [:] *user-defined-name*

password ::= *user-defined-name* | 'string'

positional-argument ::= *expression*

precision ::= integer

predicate ::= *expression* [**NOT**] **BETWEEN** *expression* **AND** *expression*

| *expression comparison-operator expression-or-subquery*

| *expression* [**NOT**] **IN** (*query-specification*)

| *expression* [**NOT**] **IN** (*value* [, *value*] . . .)

| *expression* [**NOT**] **LIKE** *value*

| *expression* **IS** [**NOT**] **NULL**

| *expression comparison-operator* **ANY** (*query-specification*)

| *expression comparison-operator* **ALL** (*query-specification*)

| *expression comparison-operator* **SOME** (*query-specification*)

| **EXISTS** (*query-specification*)

proc-expr ::= same as normal expression but does not allow IF expression, or ODBC-style scalar functions

proc-search-condition ::= same as normal search-condition, but does not allow any expression that includes a subquery.

proc-stmt ::= [*label-name* :] **BEGIN** [**ATOMIC**] [*proc-stmt* [; *proc-stmt*] . . .] **END** [*label-name*]

| **CALL** *procedure-name* (*proc-expr* [, *proc-expr*] . . .)

| **CLOSE** *cursor-name*

| **DECLARE** *cursor-name* **CURSOR FOR** *select-statement* [**FOR UPDATE** | **FOR READ ONLY**]

| **DECLARE** *variable-name data-type* [**DEFAULT** *proc-expr* | = *proc-expr*]

| **DELETE WHERE CURRENT OF** *cursor-name*

| *delete-statement*

| **FETCH** [*fetch-orientation* [**FROM**]] *cursor-name* [**INTO** *variable-name* [, *variable-name*]]

| **IF** *proc-search-condition* **THEN** *proc-stmt* [; *proc-stmt*] . . . [**ELSE** *proc-stmt* [; *proc-stmt*] . . .] **END IF**

| *insert-statement*

| **LEAVE** *label-name*

| [*label-name* :] **LOOP** *proc-stmt* [; *proc-stmt*] . . . **END LOOP** [*label-name*]

| **OPEN** *cursor-name*

| **PRINT** *proc-expr* [, '*string*']

| **RETURN** [*proc-expr*]

| *transaction-statement*

| *select-statement-with-into*

| *select-statement*

| **SET** *variable-name* = *proc-expr*

| **SIGNAL** [**ABORT**] *sqlstate-value*

| **START TRANSACTION**

| *update-statement*

| **UPDATE SET** *column-name* = *proc-expr* [, *column-name* = *proc-expr*] . . . **WHERE CURRENT OF** *cursor-name*

| [*label-name* :] **WHILE** *proc-search-condition* **DO** [*proc-stmt* [; *proc-stmt*]] . . . **END WHILE** [*label-name*]

procedure-name ::= *user-defined-name*

public-or-user-group-name ::= **PUBLIC** | *user-group-name*

query-specification [[**UNION** [**ALL**] *query-specification*] . . .
[**ORDER BY** *order-by-expression* [, *order-by-expression*] . . .]

query-specification ::= (*query-specification*)

| **SELECT** [**ALL** | **DISTINCT**] *select-list* [*table-expression*]

referencing-alias ::= **OLD** [**AS**] *correlation-name* [**NEW** [**AS**] *correlation-name*]

| **NEW** [**AS**] *correlation-name* [**OLD** [**AS**] *correlation-name]*

referential-actions ::= *referential-update-action* [*referential-delete-action*]

| *referential-delete-action* [*referential-update-action*]

referential-update-action ::= **ON UPDATE RESTRICT**

referential-delete-action ::= **ON DELETE CASCADE**

| **ON DELETE RESTRICT**

release-statement ::= see **RELEASE** statement

result ::= *user-defined-name data-type*

rollback-statement ::= see **ROLLBACK WORK** statement

savepoint-name ::= *user-defined-name*

scalar-function ::= see Scalar Function list

scale ::= integer

search-condition ::= *search-condition* **AND** *search-condition*
| *search-condition* **OR** *search-condition*
| **NOT** *search-condition*
| (*search-condition*)
| *predicate*

select-item ::= *expression* [[**AS**] *alias-name*] | *table-name* . *

select-list ::= * | *select-item* [, *select-item*] ...

set-function ::= **COUNT** (*)
| **COUNT** ([**DISTINCT** | **ALL**] *expression*)
| **SUM** ([**DISTINCT** | **ALL**] *expression*)
| **AVG** ([**DISTINCT** | **ALL**] *expression*)
| **MIN** ([**DISTINCT** | **ALL**] *expression*)
| **MAX** ([**DISTINCT** | **ALL**] *expression*)

sqlstate-value ::= '*string*'

table-constraint-definition ::= [**CONSTRAINT** *constraint-name*] *table-constraint*

table-constraint ::= **UNIQUE** (*column-name* [, *column-name*] ...)
| **PRIMARY KEY** (*column-name* [, *column-name*] ...)
| **FOREIGN KEY** (*column-name* [, *column-name*])
REFERENCES *table-name*
[(*column-name* [, *column-name*] ...)]
[*referential-actions*]

table-element ::= *column-definition*
| *table-constraint-definition*

table-expression ::=
FROM *table-reference* [, *table-reference*] ...
[**WHERE** *search-condition*]
[**GROUP BY** *expression* [, *expression*] ...
[**HAVING** *search-condition*]

table-name ::=*user-defined-name*

table-privilege ::= **ALL**
  | **SELECT** [(*column-name* [, *column-name*] . . .)]
  | **UPDATE** [(*column-name* [, *column-name*] . . .)]
  | **INSERT** [(*column-name* [, *column-name*] . . .)]
  | **DELETE**
  | **ALTER**
  | **REFERENCES**

table-reference ::= { **OJ** *outer-join-definition* }
  | *table-name* [[**AS**] *alias-name*]
  | *join-definition*
  | (*join-definition*)

transaction-statement ::= *commit-statement*
  | *rollback-statement*
  | *release-statement*

trigger-name ::= *user-defined-name*

user-password ::= *user-name* [:] *password*

user-group-name ::= *user-name* | *group-name*

user-name ::= *user-defined-name*

value ::= *literal* | **USER** | ?

value-list ::= (*value* [, *value*] . . .)

values-clause ::= **VALUES** (*expression* [, *expression*] . . .)

variable-name ::= *user-defined-name*

view-name ::= *user-defined-name*

SQL Statement List

SqlStatementList is defined as:

SqlStatementList
Statement `';'` | *SqlStatementList* `';'`
Statement `::=` *StatementLabel* `':'` *Statement*
|**BEGIN ... END** *block*
|**CALL** *Statement*
|**CLOSE CURSOR** *Statement*
|**COMMIT** *Statement*
|**DECLARE CURSOR** *Statement*
|**DECLARE** *Variable Statement*
|**DELETE** *Statement*
|**FETCH** *Statement*
|**IF** *Statement*
|**INSERT** *Statement*
|**LEAVE** *Statement*
|**LOOP** *Statement*
|**OPEN** *Statement*
|**PRINT** *Statement*
|**RELEASE SAVEPOINT** *Statement*
|**RETURN** *Statement*
|**ROLLBACK** *Statement*
|**SAVEPOINT** *Statement*
|**SELECT** *Statement*
|**SET** *Statement*
|**SIGNAL** *Statement*
|**START TRANSACTION** *Statement*
|**UPDATE** *Statement*
|**WHILE** *Statement*

Predicate

A predicate is defined as:

Expression *CompareOperator* *Expression*
|*Expression* [**NOT**] **BETWEEN** *Expression* **AND** *Expression*
|*Expression* [**NOT**] **LIKE** *StringLiteral*
|*Expression* **IS** [**NOT**] **NULL**
|**NOT** *Predicate*
|*Predicate* **AND** *Predicate*
|*Predicate* **OR** *Predicate*
|`'('` *Predicate* `')'`*CompareOperator* `::=` `'='` | `'>='` | `'>'` | `'<='` |
`'<'` | `'<>'`
|[**NOT]** **IN** *value-list*

Expression

An expression is defined as:

```
Number
|StringLiteral
|ColumnName
|VariableName
|NULL
|CONVERT '(' Expression ',' DataType ')'
|'-' Expression
|Expression '+' Expression
|Expression '-' Expression
|Expression '*' Expression
|Expression '/' Expression
|FunctionName '(' [ ExpressionList ] ')'
|'(' Expression')'
|'{' D StringLiteral '}'
|'{' T StringLiteral '}'
|'{' TS StringLiteral '}'
|@:IDENTITY
|@:ROWCOUNT
|@@IDENTITY
|@@ROWCOUNT
```

An expression list is defined as:

```
ExpressionList ::= Expression [ , Expression ... ]
```

Scalar Functions

The Pervasive ODBC Engine Interface supports ODBC scalar functions which may be included in an SQL statement as a primary expression.

This section lists the scalar functions supported by the Pervasive ODBC Engine Interface.

String Functions

String functions are used to process and manipulate columns that consist of text information, such as CHAR or LONGVARCHAR data types.

Arguments denoted as *string* can be the name of column, a string literal, or the result of another scalar function..

Table 2-18 String Functions

Function	Description
ASCII (*string*)	Returns the ASCII value of the left most character of *string*
BIT_LENGTH (*string*)	Returns the length in bits of *string*
CHAR (*code*)	Returns the ASCII character corresponding to ASCII value *code*. The argument must be an integer value.
CHAR_LENGTH (*string*)	Returns the number of characters in *string.*
CHARACTER_LENGTH (*string*)	Same as CHAR_LENGTH.
CONCAT (*string1, string2)*	Returns a string that results from combining *string1* and *string2*.
LCASE or LOWER (*string*)	Converts all upper case characters in *string* to lower case.
LEFT (*string*, *count*)	Returns the left most *count* of characters in *string*. The value of *count* is an integer.
LENGTH (*string*)	Returns the number of characters in *string*. Trailing blanks and the string termination character are not returned.

Table 2-18 String Functions

Function	Description
LOCATE (*string1*, *string2* [, *start*])	Returns the starting position of the first occurrence of *string1* within *string2*. The search within *string2* begins at the first character position unless you specify a starting position (*start*). The search begins at the starting position you specify. The first character position in *string2* is 1. The *string1* is not found, the function returns the value zero.
LTRIM (*string*)	Returns the characters of *string* with leading blanks removed.
OCTET_LENGTH (*string*)	Returns the length in bytes of *string*.
POSITION (*string1*, *string2*)	Returns the position of *string1* in *string2*. If *string1* does not exist in *string2*, a zero is returned.
REPLACE (*string1*, *string2*, *string3*)	Searches *string1* for occurrences of *string2* and replaces each with *string3*. Returns the result. If no occurrences are found, *string1* is returned.
REPLICATE (*string*, *count*)	Returns a character string composed of *string* repeated *count* times. The value of *count* is an integer.
RIGHT (*string, count*)	Returns the right most *count* of characters in *string*. The value of *count* is an integer.
RTRIM (*string*)	Returns the characters of *string* with trailing blanks removed.
SPACE (*count*)	Returns a character string consisting of *count* spaces.
STUFF (*string1*, *start, length, string2*)	Returns a character string where *length* characters in *string1* beginning at position *start* have been replaced by *string2*. The values of *start* and *length* are integers.
SUBSTRING (*string1*, *start, length*)	Returns a character string derived from *string1* beginning at the character position specified by *start* for *length* characters.
UCASE or UPPER (*string*)	Converts all lower case characters in *string* to upper case.

Queries containing a WHERE clause with scalar functions RTRIM or LEFT can be optimized. For example, consider the following query:

```
SELECT * FROM T1, T2 WHERE T1.C1 = LEFT(T2.C1, 2)
```

In this case, both sides of the predicate are optimized if T1.C1 and T2.C2 are index columns. The *predicate* is the complete search condition following the WHERE keyword. Depending on the size of the tables involved in the join, the optimizer chooses the appropriate table to process first.

RTRIM and LEFT cannot be optimized if they are contained in a complex expression on either side of the predicate.

Examples

The following example creates a new table with an integer and a character column. It inserts 4 rows with values for the character column only, then updates the integer column of those rows with the ASCII character code for each character.

```
CREATE TABLE numchars(num INTEGER,chr CHAR(1) CASE)
INSERT INTO numchars (chr) VALUES('a')
INSERT INTO numchars (chr) VALUES('b')
INSERT INTO numchars (chr) VALUES('A')
INSERT INTO numchars (chr) VALUES('B')
UPDATE numchars SET num=ASCII(chr)
SELECT * FROM numchars
```

Results of SELECT:

```
num        chr
---------- ---
97         a
98         b
65         A
66         B
```

```
SELECT num FROM numchars WHERE num=ASCII('a')
```

Results of SELECT:

```
num
------
97
```

The following example concatenates the first and last names in the Person table and results in "RooseveltBora".

```
SELECT  CONCAT(First_name, Last_name) FROM Person WHERE
First_name = 'Roosevelt'
```

The next example changes the case of the first name to lowercase and then to upper case, results in "roosevelt", "ROOSEVELT".

```
 SELECT LCASE(First_name),UCASE(First_name) FROM Person
WHERE First_name = 'Roosevelt'
```

The following example results in first name trimmed to three characters beginning from left, the length as 9 and locate results 0 . This query results in "Roo", 9, 0

```
SELECT  LEFT(First_name, 3),LENGTH(First_name),
LOCATE(First_name, 'a') FROM Person WHERE First_name =
'Roosevelt'
```

The following example illustrates use of LTRIM and RTRIM functions on strings, results in "Roosevelt", "Roosevelt", "elt".

```
SELECT LTRIM(First_name),RTRIM(First_name),
RIGHT(First_name,3) FROM Person WHERE First_name =
'Roosevelt'
```

This substring lists up to three characters starting with the second character in the first name as “oos.”

```
SELECT  SUBSTRING(First_name,2, 3) FROM Person WHERE
First_name = 'Roosevelt'

SELECT ID,first_name FROM Person WHERE LCASE(First_name)
   = 'bruce'
```

Numeric Functions

Numeric functions are used to process and manipulate columns that consist of strictly numeric information, such as decimal and integer values.

Table 2-19 Numeric Functions

Function	Description
ABS (*numeric_exp*)	Returns the absolute value of *numeric_exp*.
ACOS (*float_exp*)	Returns the arc cosine of *float_exp* as an angle, expressed in radians.
ASIN (*float_exp*)	Returns the arc sine of *float_exp* as an angle, expressed in radians.
ATAN (*float_exp*)	Returns the arc tangent of *float_exp* as an angle, expressed in radians.

Table 2-19 Numeric Functions

Function	Description
ATAN2 (*float_exp1, float_exp2*)	Returns the arc tangent of the x and y coordinates, specified by *float_exp1* and *float_exp2*, respectively, as an angle, expressed in radians.
CEILING (*numeric_exp*)	Returns the smallest integer greater than or equal to *numeric_exp*.
COS (*float_exp*)	Returns the cosine of *float_exp*, where *float_exp* is an angle expressed in radians.
COT (*float_exp*)	Returns the cotangent of *float_exp*, where *float_exp* is an angle expressed in radians.
DEGREES (*numeric_exp*)	Returns the number of degrees corresponding to *numeric_exp* radians.
EXP (*float_exp*)	Returns the exponential value of *float_exp*.
FLOOR (*numeric_exp*)	Returns the largest integer less than or equal to *numeric_exp*.
LOG (*float_exp*)	Returns the natural logarithm of *float_exp*.
LOG10 (*float_exp*)	Returns the base 10 logarithm of *float_exp*.
MOD (*integer_exp1, integer_exp2*)	Returns the remainder (modulus) of *integer_exp1* divided by *integer_exp2*.
PI ( )	Returns the constant value Pi as a floating point value.
POWER (*numeric_exp, integer_exp*)	Returns the value of *numeric_exp* to the power of *integer_exp*.
RADIANS (*numeric_exp*)	Returns the number of radians equivalent to *numeric_exp* degrees.
RAND (*integer_exp*)	Returns a random floating-point value using *integer_exp* as the optional seed value.

Table 2-19 Numeric Functions

Function	Description
ROUND (*numeric_exp*, *integer_exp*)	Returns *numeric_exp* rounded to *integer_exp* places right of the decimal point. If *integer_exp* is negative, *numeric_exp* is rounded to |*integer_exp*| (absolute value of *integer_exp*) places to the left of the decimal point.
SIGN (*numeric_exp*)	Returns an indicator of the sign of *numeric_exp*. If *numeric_exp* is less than zero, -1 is returned. If *numeric_exp* equals zero, 0 is returned. If *numeric_exp* is greater than zero, 1 is returned.
SIN (*float_exp*)	Returns the sine of *float_exp*, where *float_exp* is an angle expressed in radians.
SQRT (*float_exp*)	Returns the square root of *float_exp*.
TAN (*float_exp*)	Returns the tangent of *float_exp*, where *float_exp* is an angle expressed in radians.
TRUNCATE (*numeric_exp*, *integer_exp*)	Returns *numeric_exp* truncated to *integer_exp* places right of the decimal point. If *integer_exp* is negative, *numeric_exp* is truncated to |*integer_exp*| (absolute value) places to the left of the decimal point.

Examples

The following example lists the Modulus of the number and capacity columns in a table named room.

```
SELECT  MOD(Number, Capacity)  FROM  Room
```

The following example selects all salaries from a table named Faculty that are evenly divisible by 100.

```
SELECT Salary FROM Faculty WHERE MOD(Salary, 100) = 0
```

Time and Date Functions

Date and time functions can be used to generate, process, and manipulate data that consists of date or time data types, such as DATE and TIME.

Table 2-20 Time and Date Functions

Function	Description
CURDATE ( )	Returns the current date as a data value.
CURRENT_DATE ( )	Returns the current date. In INSERT statements, use the CURDATE variable in the values clause to insert the current date into a table.
CURTIME ( )	Returns the current local time.
CURRENT_TIME ( )	Returns the current time. In INSERT statements, use the CURTIME variable in the values clause to insert the current time into a table.
DAYNAME (*date_exp*)	Returns a character string containing the data source-specific name of the day (for example, Sunday through Saturday or Sun. through Sat. for a data source that uses English, or Sonntag through Samstag for a data source that uses German) for the day portion of *date_exp*.
DAYOFMONTH (*date_exp*)	Returns the day of the month in *date_exp* as an integer in the range of 1 to 31.
DAYOFYEAR (*date_exp*)	Returns the day of the year based on the year field in *date_exp* as an integer value in the range of 1-366.
EXTRACT (*extract_field, extract_source*)	Returns the *extract_field* portion of the *extract_source*. The *extract_source* argument is a date, time or interval expression. The permitted values of *extract_field* are: YEAR MONTH DAY HOUR MINUTE SECOND These values are returned from the target expression.

Table 2-20 Time and Date Functions

Function	Description
HOUR (*time_exp*)	Returns the hour as an integer in the rage of 0 to 23.
MINUTE (*time_exp*)	Returns the minute as an integer in the range 0 to 59.
MONTH (*date_exp*)	Returns the month as an integer in the range of 1 to 12.
MONTHNAME (*date_exp*)	Returns a character string containing the data source-specific name of the month (for example, September through December or Sept. through Dec. for a data source that uses English, or Settembre through Dicembre for a data source that uses Italian) for the month portion of *date_exp*.
NOW ( )	Returns the current date and time as a timestamp value.
QUARTER (*date_exp*)	Returns the quarter in *date_exp* as an integer value in the range of 1- 4, where 1 represents January 1 through March 31.
SECOND (*time_exp*)	Returns the second as an integer in the range of 0 to 59.
TIMESTAMPADD (*interval, integer_exp, timestamp_exp*)	Returns the timestamp calculated by adding *integer_exp* intervals of type *interval* to *timestamp_exp*. The allowed values for *interval* are: SQL_TSI_YEAR SQL_TSI_QUARTER SQL_TSI_MONTH SQL_TSI_WEEK SQL_TSI_DAY SQL_TSI_HOUR SQL_TSI_MINUTE SQL_TSI_SECOND
TIMESTAMPDIFF (*interval, timestamp_exp1, timestamp_exp2*)	Returns the integer number of intervals of type *interval* by which *timestamp_exp2* is greater than *timestamp_exp1*. The values allowed for interval are the same as for TIMESTAMPADD

Table 2-20 Time and Date Functions

Function	Description
WEEK (*date_exp*)	Returns the week of the year based on the week field in *date_exp* as an integer in the range of 1 to 53.
YEAR (*date_exp*)	Returns the year as an integer value. The range depends on the data source.

Examples

The following example illustrates the use of hour.

```
SELECT c.Name,c.Credit_Hours FROM Course c WHERE c.Name
= ANY (SELECT cl.Name FROM Class cl WHERE c.Name =
cl.Name AND c.Credit_Hours >(HOUR (Finish_Time -
Start_Time) + 1))
```

The following is an example of minute.

```
SELECT MINUTE(log) FROM billing
```

The following example illustrates the use of second.

```
SELECT SECOND(log) FROM billing
```

```
SELECT log FROM billing WHERE SECOND(log) = 31
```

The following example illustrates the use of now.

```
SELECT NOW() - log FROM billing
```

The following is a complex example that uses month, day, year, hour and minute.

```
SELECT Name, Section, MONTH(Start_Date),
DAY(Start_Date), YEAR(Start_Date), HOUR(Start_Time),
MINUTE(Start_Time) FROM Class
```

The following example illustrates use of curdate.

```
SELECT ID, Name, Section FROM Class WHERE (Start_Date -
CURDATE()) <= 2 AND (Start_Date - CURDATE()) >= 0
```

The next example gives the day of the month and day of the week of the start date of class from the class table.

```
SELECT  DAYOFMONTH(Start_date), DAYOFWEEK(Start_date)
FROM Class
```

```
SELECT * FROM person WHERE YEAR(Date_Of_Birth) < 1970
```

System Functions

System functions provide information at a system level.

Table 2-21 System Functions

Function	Description
DATABASE ( )	Returns the current database name.
USER ( )	Returns the login name of the current user.

Examples

The following examples show how to obtain the name of the current user and database:

```
SELECT USER( )
```

```
SELECT DATABASE( )
```

If you want to obtain this information for every record in a table, use the following (the example uses the Person table in DEMODATA):

```
SELECT USER( ) FROM person
```

```
SELECT DATABASE( ) FROM person
```

```
SELECT USER( ), DATABASE( ) FROM person
```

Logical Functions

Logical functions are used to manipulate data based on certain conditions.

Table 2-22 Logical Functions

Function	Description
IF (*predicate, expression1, expression2*)	Returns *expression1* if predicate is true; otherwise, returns *expression2*.
NULL ( )	Sets a column as NULL values.
IFNULL (*exp, value*)	If *exp* is NULL, *value* is returned. If *exp* is not null, *exp* is returned. The possible data type or types of *value* must be compatible with the data type of *exp*.
NULLIF (*exp1, exp2*)	NULLIF returns *exp1* if the two expressions are not equivalent. If the expressions are equivalent, NULLIF returns a NULL value.

Examples

The system scalar functions **IF** and **NULL** are SQL extensions.

IF allows you to enter different values depending on whether the condition is true or false. For example, if you want to display a column with logical values as “true” or “false” instead of a binary representation, you would use the following SQL statement:

```
SELECT IF(logicalcol=1, 'True', 'False')
```

The system scalar function NULL allows you to set a column as null values. The syntax is:

```
NULL()
```

For example, the following SQL statement retrieves null values:

```
SELECT NULL() FROM person
```

The following statements demonstrate the IFNULL and NULLIF scalar functions.You use these functions when you want to do certain value substitution based on the presence or absence of NULLs and on equality.

```
CREATE TABLE Demo (col1 CHAR(3))

INSERT INTO Demo VALUES ('abc')

INSERT INTO Demo VALUES (NULL)

INSERT INTO Demo VALUES ('xyz')
```

Since the second row contains the NULL value, `'foo'` is substituted in its place.

```
SELECT IFNULL(col1, 'foo') FROM Demo
```

This results in three rows fetched from one column:

```
"abc"
"foo"
"xyz"
3 rows fetched from 1 column.
```

The first row contains ‘abc,’ which matches the second argument of the following NULLIF call.

```
SELECT NULLIF(col1, 'abc') FROM Demo
```

A NULL is returned in its place:

```
<Null>
<Null>
"xyz"
3 rows fetched from 1 column.
```

Conversion Function

The conversion function converts an expression to a data type.

Table 2-23 Conversion Function

Function	Description
CONVERT (*exp, type*)	Converts *exp* to the *type* indicated. The possible *types* are: SQL_BIGINT SQL_BINARY SQL_BIT SQL_CHAR SQL_DATE SQL_DECIMAL SQL_DOUBLE SQL_FLOAT SQL_INTEGER SQL_LONGVARCHAR SQL_NUMERIC SQL_REAL SQL_SMALLINT SQL_TIME SQL_TIMESTAMP SQL_TINYINT SQL_VARBINARY SQL_VARCHAR SQL_LONGVARBINARY

Examples

```
SELECT  CONVERT(id , SQL_CHAR), CONVERT( '1995-06-05',
    SQL_DATE),CONVERT('10:10:10', SQL_TIME),
    CONVERT('1990-10-10 10:10:10',
    SQL_TIMESTAMP),CONVERT('1990-10-10', SQL_TIMESTAMP)
    FROM  Faculty

SELECT Name FROM Class WHERE Start_date > CONVERT ('1995-
    05-07', SQL_DATE) + 31
```

Other Characteristics

Creating Indexes

The maximum column size for varchar columns is 254 bytes if the column does not allow Null values and 253 bytes if the column is nullable.

The maximum column size for char columns is 255 bytes if the column does not allow Null values and 254 bytes if the column is nullable.

The maximum Btrieve key size is 255. When a column is nullable and indexed a segmented key is created with 1 byte for the null indicator and a maximum 254 bytes from the column indexed. Varchar columns differ from char columns in that either length byte (Btrieve lstring) or a zero terminating byte (Btrieve zstring) are reserved, reducing the effective storage by 1 byte.

Closing an Open Table

Calling SQLFreeStmt with the SQL_CLOSE option changes the SQLSTATE but does not close the open tables used by the hStmt. To close the tables currently used by hStmt, SQLFreeStmt must be called with the SQL_DROP option.

In the following example, the Emp and Dept tables remain open:

```
SQLPrepare(hStmt, "SELECT * FROM Emp, Dept", SQL_NTS)
SQLExecute(hStmt)
SQLFetch until SQL_No_Data_Found
SQLFreeStmt(hStmt, SQL_CLOSE)
```

When SQLPrepare is subsequently called on the hStmt, the tables used in the previous statement are closed. For example, when the following call is made, both the Emp and Dept tables are closed by the Pervasive ODBC Engine Interface:

```
SQLPrepare(hStmt, "SELECT * FROM Customer",SQL_NTS)
```

The following call would then close the table Customer:

```
SQLFreeStmt(hStmt, SQL_DROP)
```

Concurrency

The timeliness of data, dynamic or snapshot, is determined by whether or not execution of a query results in a sort. Queries with **DISTINCT**, **GROUP BY**, or **ORDER BY** result in a temporary sort by

Pervasive ODBC Engine Interface, unless an index exists that satisfies the required ordering.

For those queries which do not result in a temporary sort by Pervasive ODBC Engine Interface, the data fetched is from the data files. For those queries that result in a temporary sort by Pervasive ODBC Engine Interface, the data fetched is from a temporary table. The temporary table is built from the required data in the original data file at SQLExecute time.

Note For some sort operations (for example, SELECT statements where long data columns are included in the select-list, or SELECT statements with GROUP BY), Pervasive ODBC Engine Interface may use bookmarks which Pervasive ODBC Engine Interface assumes are persistent within a SELECT statement. The situation may arise whereby another application updates or deletes the row that a bookmark references.

To avoid this situation, an application may set an exclusive lock on the table being sorted through a call to SQLSetStmtOption, with fOption = 1153 and vParam = 1.

Comma as Decimal Separator

Many locales, especially in Europe, use a comma to separate whole numbers from fractional numbers within a floating point numeric field. For example, these locales would use 1,5 instead of 1.5 to represent the number one-and-one-half.

Starting with Pervasive.SQL 2000i, the engine can support both the period "." and the comma "," as decimal separators. The database engine uses the decimal separator that is defined by the regional settings for the operating system.

Note When the decimal separator is not a period, numbers appearing in SQL statements must be enclosed in quotes.

Client/Server Considerations

Support for the comma as decimal separator is based on the locale setting in the operating system. Both the client operating system and the server operating system have a locale setting. The expected behavior varies according to both settings.

- If either the server or client locale setting uses the comma as decimal separator, then the SRDE accepts both period-separated values and quoted comma-separated values.
- If neither the server nor the client locale setting uses the comma decimal separator, then the SRDE does not accept comma-separated values.

Changing the Locale Setting

Decimal separator information can only be retrieved or changed for a Win32 machine (Windows 95/98/NT/2000).

The decimal setting for NetWare and Unix cannot be configured, and it is set to a period. If you have a NetWare or Unix server engine and you want to use the comma as decimal separator, you must ensure that all your client computers are set to a locale that uses the decimal separator.

➤ To view or change your locale setting

1. From the Start menu, choose **Settings | Control Panel**.
2. In the Control Panel window, double-click **Regional Settings**.
3. On the Regional Settings tab, select the desired country.
4. You must stop and restart the Pervasive.SQL services.

Examples

Example A - Server locale uses the comma for decimal separator

Client’s locale uses comma “,” as decimal separator:

```
CREATE TABLE t1 (c1 DECIMAL(10,3), c2 DOUBLE)
INSERT INTO t1 VALUES (10.123, 1.232)
INSERT INTO t1 VALUES ('10,123', '1.232')
SELECT * FROM t1 WHERE c1 = 10.123
SELECT * FROM t1 FROM c1 = '10,123'
```

The above two select statements, if executed from the client, return:

```
10,123, 1,232
10,123, 1,232
```

Client's locale uses period "." as decimal separator:

```
CREATE TABLE t1 (c1 DECIMAL(10,3), c2 DOUBLE)
INSERT INTO t1 VALUES (10.123, 1.232)
INSERT INTO t1 VALUES ('10,123', '1.232')
SELECT * FROM t1 WHERE c1 = 10.123
SELECT * FROM t1 WHERE c1 = '10,123'
```

The above two SELECT statements, if executed from the client, return:

```
10.123, 1.232
10.123, 1.232
```

Example B - Server locale uses the period for decimal separator

Client's locale uses comma "," as DECIMAL separator:

Same as client using comma "," in Example A.

Client's locale uses period "." as DECIMAL separator:

```
CREATE TABLE t1 (c1 DECIMAL(10,3), c2 DOUBLE)
INSERT INTO t1 VALUES (10.123, 1.232)
INSERT INTO t1 VALUES ('10,123', '1,232')
   -- error in assignment
SELECT * FROM t1 WHERE c1 = 10.123
SELECT * FROM t1 WHERE c1 = '10,123'
   -- error in assignment
```

The first SELECT statement above, if executed from the client, returns:

```
10.123, 1.232
```

OEM to ANSI Support

Applications can now store or retrieve character data in the OEM character set using Pervasive.SQL, while allowing the data to be manipulated and displayed using the ANSI Windows character set. The Pervasive ODBC driver translation DLL can perform all necessary translations between the two character sets. This feature can be turned on or off for each DSN. To access the switch, click **Options...** on the Pervasive ODBC DSN Setup dialog box.

The Pervasive Control Center (PCC) and the SQL Data Manager (SQLDM) are not fully OEM-character aware if you use extended ASCII characters for column or table names. However, any character data that is passed to and from the database is correctly translated between the OEM and ANSI character sets.

If your application connects to the data source using SQLDriverConnect, you can also specify the translation DLL using the connection string option TRANSLATIONDLL=*path_and_DLL_name*. The translation DLL name for Pervasive is W32BTXLT.DLL.

NOTE: The OEM to ANSI translation option is available only for client or local engine DSNs.

Appendix

Data Types

A

Pervasive.SQL Supported Data Types

The following table shows the ODBC SQL data types that Pervasive ODBC Engine Interface supports. The application developer can use **SQLGetTypeInfo** to determine which of these ODBC SQL data types are supported by a Pervasive ODBC Engine Interface. (See the *Microsoft ODBC Programmer's Reference* for further details on **SQLGetTypeInfo**.)

Pervasive.SQL Supported Data Types

Table A-1 Pervasive.SQL Data Types

Pervasive.SQL Data Type	ODBC Data Type (ODBC type number)	Precision/ Size	Create Parameters	Unsigned	Pervasive-Oracle
BIT	SQL_BIT (-7)	1	<none>	N/A	Yes
TINYINT	SQL_TINYINT (-6)	3	<none>	No	Yes
UTINYINT	SQL_TINYINT (-6)	3	<none>	Yes	Yes
LONGVARBINARY	SQL_LONGVARBINARY (-4)	2147483648	<none>	N/A	Yes
BINARY	SQL_BINARY (-2)	255	max length	N/A	Yes
LONGVARCHAR	SQL_LONGVARCHAR (-1)	2147483648	<none>	N/A	Yes
CHAR	SQL_CHAR (1)	255	length	N/A	Yes
NUMERIC	SQL_DECIMAL (3)	15	precision,scale	No	No
DECIMAL	SQL_DECIMAL (3)	64	precision,scale	No	Yes
INTEGER	SQL_INTEGER (4)	10	<none>	No	Yes
UINTEGER	SQL_INTEGER (4)	10	<none>	Yes	Yes
IDENTITY	SQL_INTEGER (4)	10	<none>	No	No
SMALLINT	SQL_SMALLINT (5)	5	<none>	No	Yes
USMALLINT	SQL_SMALLINT (5)	5	<none>	Yes	Yes
SMALLIDENTITY	SQL_SMALLINT (5)	5	<none>	No	No
FLOAT	SQL_FLOAT	7	<none>	No	Yes
REAL	SQL_REAL (7)	7	<none>	No	Yes
DOUBLE	SQL_DOUBLE (8)	15	<none>	No	Yes
DATE	SQL_DATE (9)	10	<none>	N/A	Yes
TIME	SQL_TIME (10)	8	<none>	N/A	Yes
TIMESTAMP	SQL_TIMESTAMP (11)	19	<none>	N/A	Yes
VARCHAR	SQL_VARCHAR (12)	254	length	N/A	Yes

Supported Data Types

The table below also shows the mapping that the Pervasive ODBC Engine Interface performs between Btrieve data types and ODBC data types. The Pervasive ODBC Engine Interface converts these data types to an ODBC default type, unless another data type conversion is specified by the user when **SQLGetData** or **SQLBindCol** is called. (For a discussion of data type conversions, see Appendix D of the *Microsoft ODBC Programmer's Reference*.) An explanation of the columns in the table appears below the table.

Table A-2 Fully Supported Data Types

Pervasive.SQL Data Types	Btrieve Data Types
BINARY	CHAR[1]
BIT	BIT
TINYINT	INTEGER(1)
UTINYINT	USIGNEDINT(1)
LONGVARBINARY	BLOB[2]
LONGVARCHAR	CLOB[2]
CHAR	CHAR
DECIMAL (64,64)	DECIMAL
INTEGER	INTEGER(4)
UINTEGER	USIGNEDINT(4)
USMALLINT	USIGNEDINT(2)
SMALLINT	INTEGER(2)
REAL	FLOAT(4)
DOUBLE	FLOAT(8)
DATE	DATE
TIME	TIME
TIMESTAMP	TIMESTAMP
VARCHAR	ZSTRING

The data types in the left column of Table A-2 can be created with a CREATE TABLE statement.

[1] Indexed binary columns are created as Btrieve CHAR keys but are configured in the DDF to hold and retrieve BINARY data. The ODBC type is SQL_BINARY.

[2] Fully supported LONGVARCHAR and LONGVARBINARY data types map to column definitions BLOB, CLOB. A BLOB and CLOB are both created as an 8-byte fixed column containing a 4-byte length and 4-byte offset.

Pervasive.SQL now supports multiple LONGVARCHAR and LONGVARBINARY columns per table. The data is stored according to the offset in the variable length portion of the record. The variable length portion of data can vary from the column order of the data depending on how the data is manipulated. Consider the following example.

```
CREATE TABLE BlobDataTest
(
   Nbr   UINT,          // Fixed record (Type 14)
   Clob1 LONGVARCHAR,   // Fixed record (Type 21)
   Clob2 LONGVARCHAR,   // Fixed record (Type 21)
   Blob1 LONGVARBINARY, // Fixed record (Type 21)
)
```

On disk, the physical record would normally look like this:

```
[Fixed Data (Nbr, Clob1header, Clob2header,
Blob1header)][ClobData1][ClobData2][BlobData1]
```

Now alter column Nbr to a LONGVARCHAR column:

```
ALTER TABLE BlobDataTest ALTER Nbr LONGVARCHAR
```

On disk, the physical record now looks like this:

```
[Fixed Data (Nbrheader, Clob1header, Clob2header,
Blob1header)][ClobData1][ClobData2][BlobData1]
[NbrClobData]
```

As you can see, the variable length portion of the data is not in the column order for the existing data.

For newly inserted records, however, the variable length portion of the data is in the column order for the existing data.

```
[Fixed Data (Nbrheader, Clob1header, Clob2header,
Blob1header)][NbrClobData][ClobData1][ClobData2]
[BlobData1]
```

Notes on CHAR, VARCHAR, and LONGVARCHAR

- CHAR columns are padded with blanks to "fill" the columns
- VARCHAR/LONGVARCHAR are ***not*** padded with blanks to "fill" the columns. The significant data is terminated with a NULL character.
- In all cases the trailing blanks are NOT significant in comparison operations (LIKE and =). However, in the LIKE case, if a space is explicitly entered in the query (like 'abc %'), the space before the wildcard does matter. In this example you are looking for 'abc<space><any other character>'

Notes on BINARY and LONGVARBINARY

- BINARY columns are padded with binary zeros to "fill" the columns
- LONGVARBINARY are NOT padded with blanks to "fill" the columns.
- Current engine does not compare BINARY/LONGVARBINARY. If you try, you get "Cannot compare a binary data type." error message.

Table A-3 Partially Supported Data Types

NEW Data Types	LEGACY Data Types
BIGINT	INTEGER(8)
UBIGINT	UNSIGNEDINT(8)
CURRENCY	CURRENCY
NUMERIC	NUMERIC
IDENTITY	AUTOINC (4)
SMALLIDENTITY	AUTOINC (2)

Pervasive.SQL supports creating these columns, with the following limitations:

- BIGINT, UBIGINT data is available for read and write but get data and put data operations cannot bind default values for SQL_BIGINT or SQL_NUMERIC. These Data Types currently map to SQL_DECIMAL.

- CURRENCY is supported as a create table parameter but it is mapped to ODBC SQL_DECIMAL.
- NUMERIC will be supported as a create table parameter but it is mapped to ODBC SQL_DECIMAL.
- SMALLIDENTITY, IDENTITY are mapped to ODBC SQL_SMALLINT and SQL_INTEGER.

Table A-4 Legacy Data Types

Exposed Data Types	Legacy Data Types
BIT	LOGICAL(1)
TINYINT	LOGICAL(2)
LONGVARCHAR	LVAR
LONGVARCHAR	NOTE
DECIMAL	NUMERICSA
DECIMAL	NUMERICSTS
DECIMAL	MONEY
REAL	BFLOAT(4)
DOUBLE	BFLOAT(8)
VARCHAR	LSTRING

The above items in the right column can not be created with Pervasive.SQL grammar. To create these legacy data types please use the SQL Data Manager.

This table outlines the relationship between existing Pervasive.SQL data types and ODBC (SQL) data types. The following table lists the

Table A-5 Pervasive.SQL to ODBC Data Type Mapping

Pervasive.SQL 7.0 Data Type	Type Code	Valid Length	ODBC Type
AUTOINC	15	2	SQL_SMALLINT
		4	SQL_INTEGER
BFLOAT	9	4	SQL_REAL
		8	SQL_DOUBLE

Table A-5 Pervasive.SQL to ODBC Data Type Mapping

Pervasive.SQL 7.0 Data Type	Type Code	Valid Length	ODBC Type
BIT	16	1	SQL_BIT
CHARACTER	0	1-255	SQL_CHAR
CURRENCY	19	8	SQL_DECIMAL
DATE	3	4	SQL_DATE
DECIMAL	5	1-10	SQL_DECIMAL
FLOAT	2	4	SQL_REAL
		8	SQL_DOUBLE
INTEGER	1	1	SQL_TINYINT
		2	SQL_SMALLINT
		4	SQL_INTEGER
		8	SQL_DECIMAL
LOGICAL	7	1	SQL_BIT
		2	SQL_SMALLINT
LSTRING	10	2 - 255	SQL_VARCHAR
LVAR	13	5 - 32Kb	SQL_LONGVARCHAR
MONEY	6	1 - 10	SQL_DECIMAL
NOTE	12	5 - 32Kb	SQL_LONGVARCHAR
NUMERIC	8	1 - 15	SQL_DECIMAL
NUMERICSA	18	1 - 15	SQL_DECIMAL
NUMERICSTS	17	2 - 15	SQL_DECIMAL
STRING	0	1-255	SQL_CHAR
TIME	4	4	SQL_TIME
TIMESTAMP	20	8	SQL_TIMESTAMP
UNSIGNED	14	1	SQL_TINYINT
		2	SQL_SMALLINT

Table A-5 Pervasive.SQL to ODBC Data Type Mapping

Pervasive.SQL 7.0 Data Type	Type Code	Valid Length	ODBC Type
		4	SQL_INTEGER
		8	SQL_DECIMAL
ZSTRING	11	2 - 255	SQL_VARCHAR

valid length and valid value range for each Pervasive.SQL data type. "N/A means "not applicable.".

Table A-6 Data Type Valid Lengths and Value Ranges

Pervasive.SQL Data Type Name	ODBC Data Type (ODBC type number)	Valid Value Range	Valid Length
BIT	SQL_BIT (-7)	0 or 1	1
TINYINT	SQL_TINYINT (-6)	-128 - 127	1
UTINYINT	SQL_TINYINT (-6)	0 - 255	1
LONGVARBINARY	SQL_LONGVARBINARY (-4)	2147483647	n/a
BINARY	SQL_BINARY (-2)	N/A	1 - 255
LONGVARCHAR	SQL_LONGVARCHAR (-1)	2147483647	n/a
CHAR	SQL_CHAR (1)	N/A	1 - 255
NUMERIC	SQL_DECIMAL (3)	-9223372036854775808 – 9223372036854775807	1 - 15
BIGINT	SQL_DECIMAL	9.223372036855e+18	8
UBIGINT	SQL_DECIMAL	1.844674407371e+19	8
DECIMAL	SQL_DECIMAL (3)	Depends on the length and number of decimal places.	1 - 64
INTEGER	SQL_INTEGER (4)	-2147483648 – 2147483647	4
UINTEGER	SQL_INTEGER (4)	0 – 4294967295	4
IDENTITY	SQL_INTEGER (4)	1 – 2147483647	4
SMALLINT	SQL_SMALLINT (5)	-32768 – +32767	2
USMALLINT	SQL_SMALLINT (5)	0 – 65535	2

Table A-6 Data Type Valid Lengths and Value Ranges

Pervasive.SQL Data Type Name	ODBC Data Type (ODBC type number)	Valid Value Range	Valid Length
SMALLIDENTITY	SQL_SMALLINT (5)	1 – 32767	2
FLOAT	SQL_FLOAT	-1.79769313486232e+308 - 1.79769313486232e+308	8
REAL	SQL_REAL (7)	-3.402823e+038 - 3.402823e+038	4
DOUBLE	SQL_DOUBLE (8)	-1.79769313486232e+308 - 1.79769313486232e+308	8
DATE	SQL_DATE (9)	01-01-0001 – 12-31-9999	n/a
TIME	SQL_TIME (10)	00:00:00:00 - 23:59:59:99	n/a
TIMESTAMP	SQL_TIMESTAMP (11)	0001-01-01 00:00:00.0000000 – 9999-12-31 23:59:59.9999999 UTC	n/a
VARCHAR	SQL_VARCHAR (12)	N/A	n/a

Limitations on LONGVARCHAR and LONGVARBINARY

- The **LIKE** predicate operates on the first 65500 characters of the column data.
- All other predicates operate on the first 256 characters of the column data.
- **SELECT** statements with **GROUP BY, DISTINCT,** and **ORDER BY** return all the data but only order on the first 256 characters of the column data.
- In a single call to **SQLGetData**, the maximum number of characters returned by Pervasive ODBC Engine Interface for a LONGVARCHAR or LONGVARBINARY columns is 65500. Multiple calls must be made to **SQLGetData** to retrieve column data over 65500 characters.
- Though the maximum amount of data that can be inserted into a LONGVARCHAR/LONGVARBINARY column is 2GB, using a literal in an **INSERT** statement reduces this amount to 1000 characters. You can insert more than 1000 characters by using a parameterized insert.

Comparison of Floats

Pervasive ODBC Engine Interface compares floating point numbers in comparison predicates using an almost equals algorithm. For example, 12.203 = 12.20300000000001, and 12.203 is >= 12.20300000000001. The epsilon value defined as DBL EPSILON is (.2204460492503131e-016). This feature works for large numbers, but > and < will not be detected for small numbers; small numbers will be detected as equal.

Note If you require precision to many decimal places, use the Decimal data type instead of the Real or Float data type.

Here is the comparison routine that Pervasive ODBC Engine Interface uses for the SQL_DOUBLE data type (which maps to the C double type). For the SQL_REAL data type (which maps to the C float type), Pervasive ODBC Engine Interface uses FLT_EPSILON, which is (.2204460492503131e-016).

```
SHORT sCnvDblCmp(
DOUBLE  d1,
DOUBLE  d2)
{
if (d1 == d2)
   return 0;
if (d1 > d2)
   {
   if (d1 > d2 + DBL_EPSILON)
   return(1);
   }
else
   {
   if (d2 > d1 + DBL_EPSILON)
   return(-1);
   }

return(0);
}
```

Representation of Infinity

When Pervasive ODBC Engine Interface is required by an application to represent infinity, it can do so in either a 4-byte (C float type) or 8-byte (C double type) form, and in either a hexadecimal or character representation, as shown in the following table:

Table A-7 Infinity Representation

Value	Float Hexadecimal	Float Character	Double Hexadecimal	Double Character
Maximum Positive			0x7FEFFFFFFFFFFFFF	
Maximum Negative			0xFFEFFFFFFFFFFFFF	
Infinity Positive	0x7F800000	1E999	0x7FF0000000000000	1E999
Infinity Negative	0xFF800000	-1E999	0xFFF0000000000000	-1E999

Btrieve Data Types

For historical reasons, the two standard data types, STRING and UNSIGNED BINARY, are also offered as extended data types.

Internally, the MicroKernel compares string keys on a byte-by-byte basis, from left to right. The MicroKernel sorts string keys according to their ASCII value, however, you can define string keys to be case insensitive or to use an alternate collating sequence (ACS).

The MicroKernel compares unsigned binary keys one word at a time. It compares these keys from right to left because the Intel 8086 family of processors reverses the high and low bytes in an integer.

If a particular data type is available in more than one size (for example, both 4- and 8-byte FLOAT values are allowed), the Key Length parameter (used in the creation of a new key) defines the size that will be expected for all values of that particular key. Any attempt to define a key using a Key Length that is not allowed results in a Status 29 (Invalid Key Length).

Table A-8 lists the extended key types and their associated codes.

Table A-8 Btrieve Extended Key Types and Codes

Type	Code	Type	Code
CHAR	0	LSTRING	10
INTEGER	1	ZSTRING	11
FLOAT	2	UNSIGNED BINARY	14
DATE	3	AUTOINCREMENT	15
TIME	4	NUMERICSTS	17
DECIMAL	5	NUMERICSA	18
MONEY	6	CURRENCY	19
LOGICAL	7	TIMESTAMP	20
NUMERIC	8	WSTRING	25
BFLOAT	9	WZSTRING	26

The following sections, arranged alphabetically by key type, describe the extended key types and their internal storage formats.

AUTOINCREMENT

The AUTOINCREMENT key type is a signed Intel integer that can be either two or four bytes long. Internally, AUTOINCREMENT keys are stored in Intel binary integer format, with the high-order and low-order bytes reversed within a word. The MicroKernel sorts AUTOINCREMENT keys by their absolute (positive) values, comparing the values stored in different records a word at a time from right to left. AUTOINCREMENT keys may be used to automatically assign the next highest value when a record is inserted into a file.

The following restrictions apply to AUTOINCREMENT keys:

- An AUTOINCREMENT key must be defined as unique.
- An AUTOINCREMENT key cannot be segmented. However, an AUTOINCREMENT key can be included as an integer segment of another key, as long as the AUTOINCREMENT key has been defined as a separate, single key first, and the AUTOINCREMENT key number is lower than the segmented key number.
- An AUTOINCREMENT key cannot overlap another key.
- All AUTOINCREMENT keys must be ascending.

The MicroKernel treats AUTOINCREMENT key values as follows when you insert records into a file:

- If you specify a value of binary 0 for the AUTOINCREMENT key, the MicroKernel assigns a value to the key based on the following criteria:
  - If you are inserting the first record in the file, the MicroKernel assigns the value of 1 to the AUTOINCREMENT key.
  - If records already exist in the file, the MicroKernel assigns the key a value that is one number higher than the highest existing absolute value in the file.

- If you specify a nonzero value for the AUTOINCREMENT key, the MicroKernel inserts the record into the file and uses the specified value as the key value. If a record containing that value already exists in the file, the MicroKernel returns an error status code, and does not insert the record.

When you delete a record containing an AUTOINCREMENT key, the MicroKernel completely removes the record from the file. The MicroKernel does not reuse the deleted key value unless you specify that value when you insert another record into the file, or unless you deleted the record with the highest value..

As mentioned previously, the MicroKernel always sorts AUTOINCREMENT keys by their absolute values. For example, you can do the following:

- Specify a negative value for an AUTOINCREMENT key when you insert a record.
- Update a record and negate the value for the AUTOINCREMENT key.

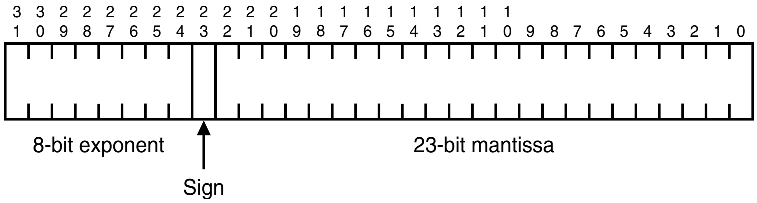
In any case, the MicroKernel sorts the key according to its absolute value. This allows you to use negation to flag records without altering the record's position in the index. In addition, when you perform a Get operation and specify a negative value in the key buffer, the MicroKernel treats the absolute value as the key. Also, if a given value is already used, the negative that value cannot be inserted since it is considered a duplicate.

You can initialize the value of a field in all or some records to zero and later add an index of type AUTOINCREMENT. This feature allows you to prepare for an AUTOINCREMENT key without actually building the index until it is needed.

When you add the index, the MicroKernel changes the zero values in each field appropriately, beginning its numbering with a value equal to the greatest value currently defined in the field, plus one. If nonzero values exist in the field, the MicroKernel does not alter them. However, the MicroKernel returns an error status code if nonzero duplicate values exist in the field.

BFLOAT

The BFLOAT key type is a single or double-precision real number. A single-precision real number is stored with a 23-bit mantissa, an 8-bit exponent biased by 128, and a sign bit. The internal layout for a 4-byte float is as follows:



The representation of a double-precision real number is the same as that for a single-precision real number, except that the mantissa is 55 bits instead of 23 bits. The least significant 32 bits are stored in bytes 0 through 3.

The BFLOAT type is commonly used in legacy BASIC applications. Microsoft refers to this data type as MBF (Microsoft Binary Format), and no longer supports this type in the Visual Basic environment.

CHAR

Note In previous versions of Pervasive.SQL, this data type was referred to as STRING

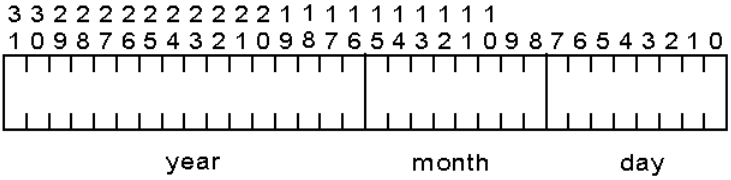
The CHAR key type is a sequence of characters ordered from left to right. Each character is represented in ASCII format in a single byte, except when the MicroKernel is determining whether a key value is null.

CURRENCY

The CURRENCY key type represents an 8-byte signed quantity, sorted and stored in Intel binary integer format; therefore, its internal representation is the same as an 8-byte INTEGER data type. The CURRENCY data type has an implied four digit scale of decimal places, which represents the fractional component of the currency data value.

DATE

The DATE key type is stored internally as a 4-byte value. The day and the month are each stored in 1-byte binary format. The year is a 2-byte binary number that represents the entire year value. The MicroKernel places the day into the first byte, the month into the second byte, and the year into a two-byte word following the month.



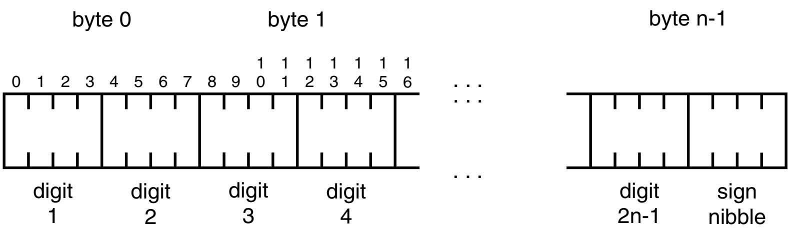
An example of C structure used for date fields would be:

```
TYPE dateField {
char day;
char month;
integer year;
}
```

The year portion of a date field is expected to be set to the integer representation of the entire year. For example, 2,001 for the year 2001.

DECIMAL

The DECIMAL key type is stored internally as a packed decimal number with two decimal digits per byte. The internal representation for an *n*-byte DECIMAL field is as follows:



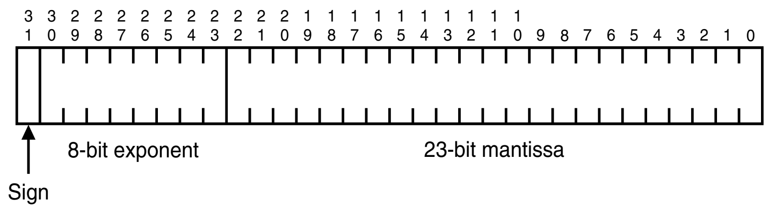
The sign nibble is either *0xF* or *0xC* for positive numbers and *0xD* for negative numbers. The decimal point is implied; no decimal point is stored in the DECIMAL field. Your application is responsible for tracking the location of the decimal point for the value in a

DECIMAL field. All the values for a DECIMAL key type must have the same number of decimal places in order for the MicroKernel to collate the key correctly. The DECIMAL type is commonly used in COBOL applications.

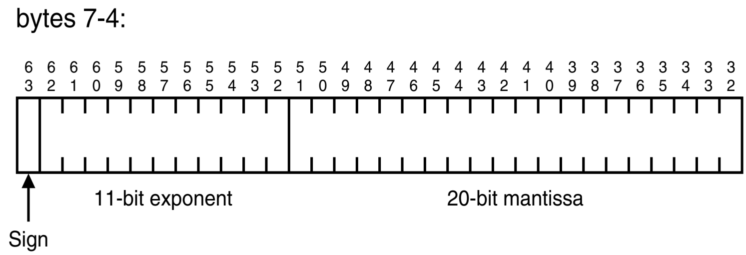
An eight-byte decimal can hold 15 digits plus the sign. A ten-byte decimal can hold 19 digits plus the sign. The decimal value is expected to be left-padded with zeros.

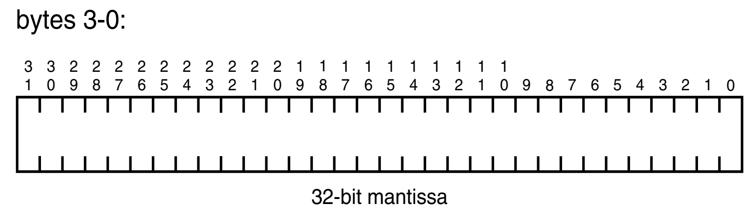
FLOAT

The FLOAT key type is consistent with the IEEE standard for single and double-precision real numbers. The internal format for a 4-byte FLOAT consists of a 23-bit mantissa, an 8-bit exponent biased by 127, and a sign bit, as follows:



A FLOAT key with 8 bytes has a 52-bit mantissa, an 11-bit exponent biased by 1023, and a sign bit. The internal format is as follows:





INTEGER

The INTEGER key type is a signed whole number and can contain any number of digits. Internally, INTEGER fields are stored in Intel binary integer format, with the high-order and low-order bytes reversed within a word. The MicroKernel evaluates the key from right to left. The sign must be stored in the high bit of the rightmost byte. The INTEGER type is supported by most development environments.

Table A-9 INTEGER Key Type

Length in Bytes	Value Ranges
1	0 – 255
2	-32768 – 32767
4	-2147483648 – 2147483647
8	-9223372036854775808 – 9223372036854775807

LOGICAL

The LOGICAL key type is stored as a 1 or 2-byte value. The MicroKernel collates LOGICAL key types as strings. Doing so allows your application to determine the stored values that represent true or false.

LSTRING

The LSTRING key type has the same characteristics as a regular STRING type, except that the first byte of the string contains the binary representation of the string's length. The LSTRING key type is limited to a maximum size of 255 bytes. The length stored in byte 0 of an LSTRING key determines the number of significant bytes. The MicroKernel ignores any values beyond the specified length of the string when sorting values. The LSTRING type is commonly used in Pascal applications.

MONEY

The MONEY key type has the same internal representation as the DECIMAL type, with an implied two decimal places.

NUMERIC

NUMERIC values are stored as ASCII strings, right justified with leading zeros. Each digit occupies one byte internally. The rightmost byte of the number includes an embedded sign with an EBCDIC value. Table A-10 indicates how the rightmost digit is represented when it contains an embedded sign for positive and negative numbers.

Table A-10 Rightmost Digit with Embedded Sign

Digit	Positive	Negative
1	A	J
2	B	K
3	C	L
4	D	M
5	E	N
6	F	O
7	G	P
8	H	Q
9	I	R
0	{	}

For positive numbers, the rightmost digit can be represented by 1 through 0 instead of A through {. The MicroKernel processes positive numbers represented either way. The NUMERIC type is commonly used in COBOL applications.

NUMERICSA

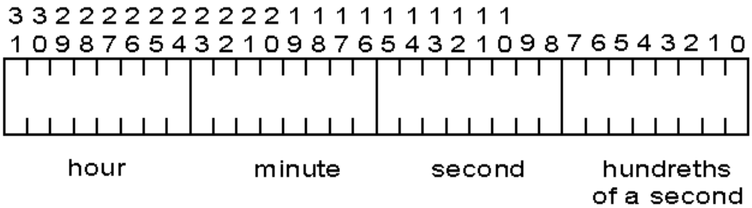
The NUMERICSA key type (sometimes called NUMERIC SIGNED ASCII) is a COBOL data type that is the same as the NUMERIC data type, except that the embedded sign has an ASCII value instead of an EBCDIC value.

NUMERICSTS

The NUMERICSTS key type (sometimes called SIGN TRAILING SEPARATE) is a COBOL data type that has values resembling those of the NUMERIC data type. NUMERICSTS values are stored as ASCII strings and right justified with leading zeros. However, the rightmost byte of a NUMERICSTS string is either “+” (ASCII 0x2B) or “-” (ASCII 0x2D). This differs from NUMERIC values that embed the sign in the rightmost byte along with the value of that byte.

TIME

The TIME key type is stored internally as a 4-byte value. Hundredths of a second, second, minute, and hour values are each stored in 1-byte binary format. The MicroKernel places the hundredths of a second value into the first byte, followed respectively by the second, minute, and hour values.



TIMESTAMP

The TIMESTAMP data type represents a time and date value. In SQL applications, use this data type to stamp a record with the time and date of the last update to the record. TIMESTAMP values are stored in 8-byte unsigned values representing septa seconds (10^{-7} second) since January 1, 0001 in a Gregorian calendar.

TIMESTAMP is intended to cover time and data values made up of the following components: year, month, day, hour, minute, and second. The following table indicates the valid values of each of these components:

Table A-11 TIMESTAMP Data Type

YEAR	0001 to 9999
MONTH	01 to 12
DAY	01 to 31, constrained by the value of MONTH and YEAR in the Gregorian calendar.
HOUR	00 to 23
MINUTE	00 to 59
SECOND	00 to 59

UNSIGNED BINARY

The MicroKernel sorts UNSIGNED BINARY keys as unsigned INTEGER keys. An UNSIGNED BINARY key could contain any even number of bytes. The MicroKernel compares UNSIGNED BINARY keys from right to left.

An UNSIGNED BINARY key is sorted in the same manner as an INTEGER key. The differences between an UNSIGNED BINARY key and an INTEGER key are that an INTEGER has a sign bit, while an UNSIGNED BINARY type does not, and an UNSIGNED BINARY key can be longer than 4 bytes.

WSTRING

WSTRING is a Unicode string that is not null-terminated. The length of the string is determined by the field length.

WZSTRING

WZSTRING is a Unicode string that is double null-terminated. The length of this string is determined by the position of the Unicode NULL (two null bytes) within the field. This corresponds to the ZSTRING type supported in Btrieve.

ZSTRING

The ZSTRING key type corresponds to a C string. It has the same characteristics as a regular string type except that a ZSTRING type is terminated by a binary 0. The MicroKernel ignores any values beyond the first binary 0 it encounters in the ZSTRING, except when the MicroKernel is determining whether a key value is null.

Appendix

SQL Reserved Words

B

Supported Pervasive.SQL Reserved Words

Reserved words have one or more specific meaning and are recognized as having such in SQL. For example, **SELECT** is a reserved word and has special meaning as a statement. It is important to remember that reserved words should not be used as variable or dictionary names.

This appendix contains the following topic:

List of Reserved Words

Table B-1 SQL Reserved Words and Symbols

#	;	:	
ABORT	ACTION	ADD	AFTER
ALL	ALTER	AND	ANY
AS	ASC	ATOMIC	AUTHORIZATION
AVG	BEFORE	BEGIN	BETWEEN
BY	CALL	CASCADE	CASE
CHECK	CLOSE	COBOL	COLLATE
COLUMN	COMMIT	COMMITTED	CONSTRAINT
CONVERT	COUNT	CREATE	CREATETAB
CROSS	CS	CURRENT	CURSOR
D	DECLARE	DEFAULT	DELETE
DESC	DIAGNOSTICS	DISTINCT	DO
DROP	EACH	ELSE	END
ESCAPE	EX	EXISTS	FETCH
FOR	FOREIGN	FROM	FULL
GRANT	GROUP	HANDLER	HAVING
IF	IN	INDEX	INNER
INOUT	INSERT	INTERNAL	INTO
IS	ISOLATION	JOIN	KEY
LANGUAGE	LEAVE	LEFT	LEVEL
LIKE	LOGIN	LOOP	MAX
MIN	MODIFIABLE	MODULE	NEW
NEXT	NO	NOT	NULL
OF	OLD	ON	ONLY

Table B-1 SQL Reserved Words and Symbols

OPEN	OPTION	OR	ORDER
OUT	OUTER	PRIMARY	PRINT
PRIVLEGES	PROCEDURE	PUBLIC	READ
REFERENCES	REFERENCING	RELEASE	REPEAT
REPEATABLE	RESTRICT	RETURN	RETURNS
REVOKE	RIGHT	ROLLBACK	ROQ
SAVEPOINT	SCHEMA	SECURITY	SELECT
SERIALIZABLE	SET	SIGNAL	SIZE
SQLSTATE	SSP_EXPRE	SSP_PRED	START
SUM	SVBEGIN	SVEND	TABLE
THEN	TO	TRANSACTION	TRIGGER
TS	UNCOMMITTED	UNION	UNIQUE
UNTIL	UPDATE	USER	USING
VALUES	VIEW	WHEN	WHERE
WHILE	WITH	WORK	WRITE

Appendix C

SQL API Mapping to ODBC

Summary of SQL API Mappings

This appendix contains tables of Pervasive.SQL and ODBC functions. The tables represent the following categories of functions:

SQL API to ODBC Mapping Tables

Table C-1 Connection and Session Control APIs

Deprecated Scalable SQL API	Recommended ODBC API
XQLLogin	1. SQLAllocHandle or SQLAllocEnv for environment handles. 2. SQLSetEnvAttr (Optional) to set driver attributes. 3. SQLAllocHandle or SQLAllocConnect for a connection handle. 4. SQLSetConnectAttr (Optional) to set connection attributes. 5. SQLConnect or SQLBrowseConnect or SQLDriverConnect to make a connection.
XQLLogout	1. SQLDisconnect to break a connection. 2. SQLFreeHandle or SQLFreeConnect to release connection handle. 3. SQLFreeHandle or SQLFreeEnv to release an environment handle.
XGetSessionID	You will have a session ID once you are connected to your database. This is the Connection handle, allocated and connected during login.
XPutSessionID	You will not need to put session because all connections you make are available concurrently.

Table C-2 Preparing and Executing SQL Request APIs

Deprecated Scalable SQL API	Recommended ODBC API
XQLCursor	1. SQLAllocHandle or SQLAllocStmt to allocate a statement handle. 2. SQLSetCursorName may be used to associate a name with the cursor handle.
XQLCompile	SQLExecDirect or SQLExecute
XQLSubst	SQLPrepare, SQLBindParameter, SQLParamOptions, SQLPutData
XQLExec	SQLExecDirect or SQLExecute
xAccess	1. Grants privileges: no direct ODBC API, but available through the GRANT statement. 2. Revokes privileges: no direct ODBC API, but available through the REVOKE statement. 3. Fetch privileges: SQLTablePrivileges and SQLColumnPrivileges are the associated ODBC APIs. The Master user also has the option of using a SELECT statement to retrieve the privileges that each user has.

Table C-2 Preparing and Executing SQL Request APIs

Deprecated Scalable SQL API	Recommended ODBC API
xChar	1. Define NULL values for Scalable SQL data types: no ODBC API and not available through SQL. This is applicable for legacy databases and applications, where the application made use of some value other than the default NULL values. That is, legacy NULL behavior. 2. Retrieve the blank replacement char, or one of the null values: no ODBC API, and not available through SQL. Null values are applicable for legacy databases and applications, where the application made use of some non-default value. Blank replacement char is no longer applicable since dictionary names with balnks can be accessed by putting double quotes around them.

Table C-2 Preparing and Executing SQL Request APIs

Deprecated Scalable SQL API	Recommended ODBC API
xDD	1. Create a dictionary: no ODBC API, and not available through SQL. With Pervasive.SQL 2000, we eliminated support for standalone dictionaries. Dictionaries can only be accessed through named databases. The ability to create a named database programatically is available through the Distributed Tuning Interface (DTI), which is documented in the Pervasive.SQL Software Development Kit. The DTI allows creating named databases AND the dictionary files. 2. Remove an existing dictionary: no ODBC API, and not available through SQL. DTI will also allows deleting a named database AND the dictionary files, and then the named database can be re-added. This causes a delete of the dictionary files only. 3. Replace an existing dictionary: No ODBC API, not available through SQL. You can delete the named database and the dictionary files, and then recreate both, causing a replacement of the dictionary.

Table C-2 Preparing and Executing SQL Request APIs

Deprecated Scalable SQL API	Recommended ODBC API
xDDAttr	1. Masks and Headings (Add, Modify, Remove, Fetch): no ODBC API, and not available through SQL. Through the ODBC API, data is transferred in common formats, and even conversions from one data type to another are well defined behaviorally. This means that masks and headings are no longer necessary, or appropriate. 2. Other attributes (Add, Modify, Remove, Fetch): no ODBC API, and not available through SQL. The existing attributes are enforced with Pervasive.SQL, but they cannot be changed or removed. New default values can be defined with SQL, but no check constraints (or character lists, value lists, range lists, etc.) can be defined.

Table C-2 Preparing and Executing SQL Request APIs

Deprecated Scalable SQL API	Recommended ODBC API
xRemove	1. This API is partially supported through the ODBC Cursor Library support for SQLSetPos, SQLExtendedFetch, and ODBC named cursors. Using DELETE ... WHERE CURRENT OF <cursor name>, an application can remove the current record based on the positioning within a cursor.
xUser	1. Add a user/group: no ODBC API, available through the GRANT LOGIN or CREATE GROUP statement in SQL. 2. Drop a user/group: no ODBC API, available through the REVOKE LOGIN or DROP GROUP statement in SQL. 3. Retrieve a list of users: the Master user can query the "X$User" system table to find all users, what group each is in (if any), whether the user is a group instead of a user, and whether the user/group has the create table privilege. 4. Grant/Revoke the "create table" privilege: no ODBC API, available through the GRANT/ REVOKE CREATETAB statements.

Table C-3 Data Retrieval APIs

Scalable SQL	ODBC
XQLFetch	SQLFetch, SQLExtendedFetch, or SQLGetData
XQLDescribe	SQLDescribeCol, SQLColAttributes or SQLColAttribute
XQLStatus	SQLError
xFetch	SQLFetch or SQLExtendedFetch
xStatus	SQLError

Table C-4 Statement Termination APIs

Scalable SQL	ODBC
xReset	SQLFreeStmt, SQLCancel, SQLTransact
XQLFree	SQLFreeHandle

Table C-5 Database and Driver Information APIs

Scalable SQL	ODBC
SQLVersion	SQLGetInfo

Table C-6 Metadata Information APIs

Scalable SQL	ODBC
xDDField	SQLColAttribute
xDDFile	SQLTables
xDDIndex	SQLStatistics

Table C-7 Transaction APIs

Scalable SQL	ODBC
Start Transaction	SQLSetConnectAttr
Commit	SQLTransAct
Rollback	SQLTransAct

Table C-8 Deprecated Scalable SQL APIs

Scalable SQL
xInsert
xPassword
xUpdate
XShareSessionID
XQLFormat
XQLMask
XQLConvert
SQLGetCountDatabaseNames
SQLGetCountRemoteDatabaseNames
SQLGetRemoteDatabaseNames
SQLUnloadDBnames
XQLValidate

Appendix

System Tables

D

Pervasive.SQL System Tables Reference

This appendix describes the Pervasive.SQL system tables. For each system table, the following table indicates the name of the associated file and briefly describes the system table's contents.

Note Some data in the system tables cannot be displayed. For example, information about stored views and procedures, other than their names, is available only to Pervasive.SQL. In addition, some data (such as user passwords) displays in encrypted form.

Table D-1 System Tables

System Table	Dictionary File	Contents
X$File	FILE.DDF	Names and locations of the tables in your database.
X$Field	FIELD.DDF	Column and named index definitions.
X$Index	INDEX.DDF	Index definitions.
X$Attrib	ATTRIB.DDF	Column attributes definitions.
X$View	VIEW.DDF	View definitions.
X$Proc	PROC.DDF	Stored procedure definitions.
X$User	USER.DDF	User names, group names, and passwords.
X$Rights	RIGHTS.DDF	User and group access rights definitions.
X$Relate	RELATE.DDF	Referential integrity (RI) information.

Table D-1 System Tables continued

System Table	Dictionary File	Contents
X$Trigger	TRIGGER.DDF	Trigger information.
X$Depend	DEPEND.DDF	Trigger dependencies such as tables, views, and procedures.

When you issue a CREATE DICTIONARY statement, Pervasive.SQL creates the X$File, X$Field, and X$Index system tables and the associated dictionary files. Pervasive.SQL creates the other system tables as follows:

- X$Attrib—When you define column attributes, Pervasive.SQL creates this table and stores the definitions.
- X$View—When you define views, Pervasive.SQL creates this table and stores the definitions.
- X$Proc—When you define stored procedures, Pervasive.SQL creates this table and stores the definitions.
- X$User and X$Rights—When you set up data security on the database, Pervasive.SQL creates these two tables. In X$User, Pervasive.SQL stores information about user names, group names, and passwords. In X$Rights, Pervasive.SQL stores information about the access rights assigned to users and groups. When you disable security, Pervasive.SQL deletes these two tables.
- X$Relate—When you define RI constraints for the database, Pervasive.SQL creates this table and stores information about foreign key references.
- X$Trigger and X$Depend—When you define triggers for tables in the database, Pervasive.SQL creates these two tables. In X$Trigger, Pervasive.SQL stores information about the triggers. In X$Depend, Pervasive.SQL stores information about the trigger dependencies.

Because the system tables are part of the database, you can query them to retrieve information about the database. However, to update the system tables, you must use data definition statements. You cannot update them with data manipulation statements as you would standard data tables; this may corrupt the dictionary.

Installing System Tables and Data Dictionary Files

The system tables included with Pervasive.SQL contain the data dictionary files for the sample database. When you install Pervasive.SQL, you can copy this data dictionary to the appropriate device on your system and log in to the sample database. After logging in, you can create a new data dictionary in another directory of your choice. Alternatively, you can create a new data dictionary using the Configuration utility in the Pervasive Control Center (PCC) to define a bound or unbound named database.

X$File

The X$File system table is associated with the file FILE.DDF. For each table defined in the database, X$File contains the table name, the location of the associated table, and a unique internal ID number that Pervasive.SQL assigns. The structure of X$File is as follows:

Table D-2 X$File System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xf$Id	USMALLINT	2	N/A	Internal ID Pervasive.SQL assigns.
Xf$Name	CHAR	20	Yes	Table name.
Xf$Loc	CHAR	64	No	File location (pathname).
Xf$Flags	UTINYINT	1	N/A	File flags. If bit 4=1, the file is a dictionary file. If bit 4=0, the file is user-defined. If bit 6=1, the table supports true nullable columns.
Xf$Reserved	CHAR	10	No	Reserved.

Two indexes are defined for the X$File table.

Table D-3 X$File System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xf$Id	No	N/A	No
1	0	Xf$Name	No	Yes	No

Note Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Field

The X$Field system table is associated with the file FIELD.DDF. X$Field contains information about all the columns and named indexes defined in the database. The structure of X$Field is as follows:

Table D-4 X$Field System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xe$Id	USMALLINT	2	N/A	Internal ID Pervasive.SQL assigns, unique for each field in the database.
Xe$File	USMALLINT	2	N/A	ID of table to which this column or named index belongs. It corresponds to Xf$Id in X$File.
Xe$Name	CHAR	20	Yes	Column name or index name.
Xe$DataType	UTINYINT	1	N/A	Control field - Column data type (range 0–26). If value is 227, it represents a constraint name. If value is 255, it represents an index name.
Xe$Offset	USMALLINT	2	N/A	Column offset in table; index number if named index. Offsets are zero-relative.
Xe$Size	USMALLINT	2	N/A	Column size, representing the internal storage, in bytes, required for the field.

Table D-4 X$Field System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xe$Dec	UTINYINT	1	N/A	Column decimal place (for DECIMAL, NUMERIC, NUMERICSA, NUMERICSTS, MONEY, or CURRENCY types). Relative bit positions for contiguous bit columns. Fractional seconds for TIMESTAMP data type.
Xe$Flags	USMALLINT	2	N/A	Flags word. Bit 0 is the case flag for string data types. If bit 0 = 1, the field is case insensitive. If bit 2 = 1, the field allows null values. If bit 12 = 1, the field is interpreted as binary.

The column Xe$File corresponds to the column Xf$Id in the X$File system table and is the link between the tables and the columns they contain. So, for example, the following query shows you all of the field definitions in order for the Billing table.

```
SELECT "X$Field".*
   FROM X$File,X$Field
   WHERE Xf$Id=Xe$File AND Xf$Name = 'Billing'
ORDER BY Xe$Offset
```

The integer values in column Xe$DataType are codes that represent the Pervasive.SQL data types. See "Data Types" on page A-1 for the codes.

Five indexes are defined for the X$Field table, as follows:

Table D-5 X$Field System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xe$Id	No	N/A	No
1	0	Xe$File	Yes	N/A	No
2	0	Xe$Name	Yes	Yes	No
3	0	Xe$File	No	N/A	Yes
3	1	Xe$Name	No	Yes	No
4	0	Xe$File	Yes	N/A	Yes
4	1	Xe$Offset	Yes	N/A	Yes
4	2	Xe$Dec	Yes	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Index

The X$Index system table is associated with the file INDEX.DDF. X$Index contains information about all the indexes defined on the tables in the database. The structure of X$Index is as follows:

Table D-6 X$Index System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xi$File	USMALLINT	2	N/A	Unique ID of the table to which the index belongs. It corresponds to Xf$Id in X$File.
Xi$Field	USMALLINT	2	N/A	Unique ID of the index column. It corresponds to Xe$Id in X$Field.
Xi$Number	USMALLINT	2	N/A	Index number (range 0–119).
Xi$Part	USMALLINT	2	N/A	Segment number (range 0–119).
Xi$Flags	USMALLINT	2	N/A	Index attribute flags.

The Xi$File column corresponds to the Xf$Id column in the X$File system table. The Xi$Field column corresponds to the Xe$Id column in the X$Field system table. Thus, an index segment entry is linked to a file and to a field.

The Xi$Flags column contains integer values that define the index attributes. The following table describes how Pervasive.SQL interprets each bit position when the bit has the binary value of 1. Bit position 0 is the rightmost bit in the integer.

Table D-7 X$Index System Table Index Definitions

Bit Position	Decimal Equivalent	Description
0	1	Index allows duplicates.
1	2	Index is modifiable.
2	4	Indicates an alternate collating sequence.

Table D-7 X$Index System Table Index Definitions

Bit Position	Decimal Equivalent	Description
3	8	Null values are not indexed (refers to Btrieve NULLs, not SQL true NULLS).
4	16	Another segment is concatenated to this one in the index.
5	32	Index is case-insensitive.
6	64	Index is collated in descending order.
7	128	Index is a named index.
8	256	Index is a Btrieve extended key type.
13	8192	Index is a foreign key.
14	16384	Index is a primary key referenced by some foreign key.

The value in the Xi$Flags column for a particular index is the sum of the decimal values that correspond to that index's attributes. Three indexes are defined for the X$Index table, as follows:

Table D-8 X$Index System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xi$File	Yes	N/A	No
1	0	Xi$Field	Yes	N/A	No
2	0	Xi$File	No	N/A	Yes
2	1	Xi$Number	No	N/A	Yes
2	2	Xi$Part	No	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

To see the information about the index segments defined for the Billing table, for example, issue the following query:

```
SELECT Xe$Name,Xe$Offset, "X$Index".*
    FROM X$File,X$Index,X$Field
    WHERE Xf$Id=Xi$File and Xi$Field=Xe$Id and Xf$Name =
        'Billing'
ORDER BY Xi$Number,Xi$Part
```

X$Attrib

The X$Attrib system table is associated with the file ATTRIB.DDF. X$Attrib contains information about the column attributes of each column in the database; there is an entry for each column attribute you define. The structure of X$Attrib is as follows:

Table D-9 X$Attrib System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xa$Id	USMALLINT	2	N/A	Corresponds to Xe$Id in X$Field.
Xa$Type	CHAR	1	No	C for character, D for default, H for heading, M for mask, O for column collation, R for range, or V for value.
Xa$ASize	USMALLINT	2	N/A	Length of text in Xa$Attrib.
Xa$Attrs	LONGVARCHAR (NOTE)	<=20 48	N/A	Text that defines the column attribute.

When you define multiple attributes for a single column, the X$Attrib system table contains multiple entries for that column ID—one for each attribute you define. If you do not define column attributes for a particular column, that column has no entry in the X$Attrib table. The text in the Xa$Attrs column appears exactly as you define it with Pervasive.SQL. One index is defined for the X$Attrib table, as follows:

Table D-10 X$Attrib System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xa$Id	No	N/A	Yes
0	1	Xa$Type	No	No	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

Note Attribute type C, H, M, R and V are legacy validation types valid only in a Pervasive.SQL 7 or Scalable SQL environment. Pervasive.SQL 2000i uses only the D (default) and O (column collation) attributes.

X$View

The X$View system table is associated with the file VIEW.DDF. X$View contains view definitions, including information about joined tables and the restriction conditions that define views. You can query the X$View table to retrieve the names of the views that are defined in the dictionary.

The first column of the X$View table contains the view name; the second and third columns describe the information found in the LVAR column, Xv$Misc. The structure of X$View is as follows:

Table D-11 X$View System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xv$Name	CHAR	20	Yes	View name.
Xv$Ver	UTINYINT	1	N/A	Version ID.
Xv$Id	UTINYINT	1	N/A	Sequence number.
Xv$Misc	LONGVARCHAR (LVAR)	<=2000	N/A	Pervasive.SQL internal definitions.

Two indexes are defined for the X$View table, as follows:

Table D-12 X$View System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xv$Name	Yes	Yes	No
1	0	Xv$Name	No	Yes	Yes
1	1	Xv$Ver	No	N/A	Yes
1	2	Xv$Id	No	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Proc

The X$Proc system table is associated with the file PROC.DDF. X$Proc contains the compiled structure information for every stored procedure defined. The structure of X$Proc is as follows:

Table D-13 X$Proc System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xp$Name	CHAR	30	Yes	Stored procedure name.
Xp$Ver	UTINYINT	1	N/A	Version ID.
Xp$Id	USMALLINT	2	N/A	0-based Sequence Number.
Xp$Flags	UTINYINT	1	N/A	1 for stored statement, 2 for stored procedure or 3 for external procedure.
Xp$Misc	LONGVARCHAR (LVAR)	990	N/A	Internal representation of stored procedure.

Note Stored procedures and external procedures were supported in versions prior versions of Pervasive.SQL. Only stored procedures are supported in Pervasive.SQL 2000i.

One index is defined for the X$Proc table, as follows:

Table D-14 X$Proc System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xp$Name	No	Yes	Yes
0	1	Xp$Id	No	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$User

The X$User system table is associated with the file USER.DDF. X$User contains the name and password of each user and the name of each user group. Pervasive.SQL uses this table only when you enable the security option. The structure of X$User is as follows:

Table D-15 X$User System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xu$Id	USMALLINT	2	N/A	Internal ID assigned to the user or group.
Xu$Name	CHAR	30	Yes	User or group name.
Xu$Password	CHAR	9	No	User password (encrypted)
Xu$Flags	USMALLINT	2	N/A	User or group flags.

Note For any row in the X$User system table that describes a group, the column value for Xu$Password is NULL.

The Xu$Flags column contains integer values whose rightmost 8 bits define the user or group attributes. The following table describes how Pervasive.SQL interprets each bit position when the bit has the binary value of 1. Bit position 0 is the rightmost bit in the integer.

Table D-16 Xu$Flags System Table Bit Position Definitions

Bit Position	Decimal Equivalent	Description
0	1	Reserved.
1	2	Reserved.
2	4	Reserved.
3	8	Reserved.
4	16	Reserved.
5	32	Reserved.
6	64	Name is a group name.
7	128	User or group has the right to define tables in the dictionary.

The value in the Xu$Flags column for a particular user or group is the sum of the decimal values corresponding to the attributes that apply to the user or group.

Two indexes are defined for the X$User table, as follows:

Table D-17 X$User System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xu$Id	Yes	N/A	No
1	0	Xu$Name	No	Yes	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Rights

The X$Rights system table is associated with the file RIGHTS.DDF. X$Rights contains access rights information for each user. Pervasive.SQL uses this table only when you enable the security option. The structure of X$Rights is as follows:

Table D-18 X$Rights System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xr$User	USMALLINT	2	N/A	User ID
Xr$Table	USMALLINT	2	N/A	Table ID
Xr$Column	USMALLINT	2	N/A	Column ID
Xr$Rights	UTINYINT	1	N/A	Table or column rights flag

The Xr$User column corresponds to the Xu$Id column in the X$User table. The Xr$Table column corresponds to the Xf$Id column in the X$File table. The Xr$Column column corresponds to the Xe$Id column in the X$Field table.

Note For any row in the system table that describes table rights, the value for Xr$Column is null.

The Xr$Rights column contains integer values whose rightmost 8 bits define the users' access rights. The following table describes how Pervasive.SQL interprets the value. Values from this table may be combined into a single Xr$Rights value.

Table D-19 Xr$Rights System Table Bit Position Definitions

Hex Value	Decimal Equivalent	Description
1	1	Reorganization in progress.
0x90	144	References rights to table.
0xA0	160	Alter Table rights.
0x40	64	Select rights to table or column.
0x82	130	Update rights to table or column.
0x84	132	Insert rights to table or column.
0x88	136	Delete rights to table or column.

A decimal equivalent of 0 implies no rights.

The value in the Xr$Rights column for a particular user is the bit-wise or of the hex values corresponding to the access rights that apply to the user.

Three indexes are defined for the X$Rights table, as follows:

Table D-20 X$Rights System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xr$User	Yes	N/A	No
1	0	Xr$User	No	N/A	Yes
1	1	Xr$Table	No	N/A	Yes
1	2	Xr$Column	No	N/A	No
2	0	Xr$Table	Yes	N/A	Yes
2	1	Xr$Column	Yes	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Relate

The X$Relate system table is associated with the file RELATE.DDF. X$Relate contains information about the referential integrity (RI) constraints defined on the database. X$Relate is automatically created when the first foreign key is created, since this results in a relationship being defined.

The structure of X$Relate is as follows:

Table D-21 X$Relate System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xr$PId	USMALLINT	2	N/A	Primary table ID.
Xr$PIndex	USMALLINT	2	N/A	Index number of primary key in primary table.
Xr$FId	USMALLINT	2	N/A	Dependent table ID.
Xr$FIndex	USMALLINT	2	N/A	Index number of foreign key in dependent table.
Xr$Name	CHAR	20	Yes	Foreign key name.
Xr$UpdateRule	UTINYINT	1	N/A	1 for restrict.
Xr$DeleteRule	UTINYINT	1	N/A	1 for restrict, 2 for cascade.
Xr$Reserved	CHAR	30	No	Reserved.

Five indexes are defined for the X$Relate table, as follows:

Table D-22 X$Relate System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xr$PId	Yes	N/A	No
1	0	Xr$FId	Yes	N/A	No
2	0	Xr$Name	No	Yes	No
3	0	Xr$PId	No	N/A	Yes
3	1	Xr$Name	No	Yes	No
4	0	Xr$FId	No	N/A	Yes
4	1	Xr$Name	No	Yes	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Trigger

The X$Trigger system table is associated with the file TRIGGER.DDF. X$Trigger contains information about the triggers defined for the database. The structure of X$Trigger is as follows:

Table D-23 X$Trigger System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xt$Name	CHAR	30	Yes	Trigger name.
Xt$Version	USMALLINT	2	N/A	Trigger version. A 4 indicates Scalable SQL v4.
Xt$File	USMALLINT	2	N/A	File on which trigger is defined. Corresponds to Xf$Id in X$File.
Xt$Event	UNSIGNED	1	N/A	0 for INSERT, 1 for DELETE, 2 for UPDATE.
Xt$ActionTime	UTINYINT	1	N/A	0 for BEFORE, 1 for AFTER.
Xt$ForEach	UTINYINT	1	N/A	0 for ROW (default), 1 for STATEMENT.
Xt$Order	USMALLINT	2	N/A	Order of execution of trigger.
Xt$Sequence	USMALLINT	2	N/A	0-based sequence number.
Xt$Misc	LONGVARCHAR (LVAR)	<=4054	N/A	Internal representation of trigger.

A given trigger may require multiple entries in Trigger.DDF. Each entry has the same triggern name in the Xt$Name field, and is used in the order specified by the Xt$Sequence field.

Three indexes are defined for the X$Trigger table, as follows:

Table D-24 X$Trigger System Table Index Definitions

Index Number	Segment Number	Column Name	Duplicates	Case Insensitive	Segmented
0	0	Xt$Name	No	Yes	Yes
0	1	Xt$Sequence	No	N/A	No
1	0	Xt$File	No	N/A	Yes
1	1	Xt$Name	No	Yes	No
2	0	Xt$File	Yes	N/A	Yes
2	1	Xt$Event	Yes	N/A	Yes
2	2	Xt$ActionTime	Yes	N/A	Yes
2	3	Xt$ForEach	Yes	N/A	Yes
2	4	Xt$Order	Yes	N/A	Yes
2	5	Xt$Sequence	Yes	N/A	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

X$Depend

The X$Depend system table is associated with the file DEPEND.DDF. X$Depend contains information about trigger dependencies such as tables, views, and procedures. The structure of X$Depend is as follows:

Table D-25 X$Depend System Table Structure

Column Name	Type	Size	Case Insensitive	Description
Xd$Trigger	CHAR	30	Yes	Name of trigger. It corresponds to Xt$Name in X$Trigger.
Xd$DependType	UNSIGNED	1	N/A	1 for Table, 2 for View, 3 for Procedure.
Xd$DependName	CHAR	30	Yes	Name of dependency with which the trigger is associated. It corresponds to either Xf$Name in X$File, Xv$Name in X$View, or Xp$Name in X$Proc.

Two indexes are defined for the X$Depend table, as follows:

Table D-26 X$Depend System Table Index Definitions

Index Number	Segment Number	Column Name	Dupli-cates	Case Insensitive	Segmented
0	0	Xd$Trigger	No	Yes	Yes
0	1	Xd$DependType	No	N/A	Yes
0	2	Xd$DependName	No	Yes	No
1	0	Xd$DependType	Yes	N/A	Yes
1	1	Xd$DependName	Yes	Yes	No

Index Number corresponds to the value stored in the Xi$Number column in the X$Index system table. Segment Number corresponds to the value stored in the Xi$Part column in the X$Index system table.

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