MERANT™

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DataDirect®
Connect ODBC™

Reference

Windows 9*x*, Windows NT, and UNIX

ACKNOWLEDGEMENT. PVCS® Dimensions™ is implemented using the ORACLE® Relational database management system. ORACLE is a registered trademark of Oracle Corporation, Redwood City, California.

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Mountain View, California 94043

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Preface

This book is your reference to MERANT™ DataDirect® Connect ODBC™. The DataDirect Connect ODBC product consists of a number of database *drivers* that are compliant with the Open Database Connectivity (ODBC) specification.

Using this Manual

The content of this manual is based on the assumption that you are familiar with your operating system and its commands. It contains the following chapters:

- An introductory chapter (Chapter 1, "Getting Started," on page 31) that explains the DataDirect Connect ODBC drivers and ODBC, discusses environment-specific subjects, and explains the error messages returned by the drivers.
- A chapter for each database driver. Each driver's chapter is structured in the same way. First, it lists system requirements for your operating environment. Next, it explains how to configure a data source. Finally, it explains how to connect to that data source.

This manual also includes several appendixes that provide information on technical topics:

- Appendix A, "SQL for Flat-File Drivers," on page 377 explains the SQL statements that you can use with Btrieve, dBASE, Excel, Paradox, and text files.
- Appendix B, "Using Indexes," on page 403 provides general guidelines on how to improve performance when querying a database system.

- Appendix C, "ODBC API and Scalar Functions," on page 411 lists the ODBC API functions that each driver supports. Any exceptions are listed in the appropriate driver chapter, under the section "ODBC Conformance Level." This appendix also lists the ODBC scalar functions.

- Appendix D, "Locking and Isolation Levels," on page 423 provides a general discussion of isolation levels and locking.

- Appendix E, "Performance Design of ODBC Applications," on page 429 provides guidelines for designing performance-oriented ODBC applications.

- Appendix F, "Threading," on page 449 discusses how ODBC ensures thread safety.

- Appendix G, "Microsoft Query '97," on page 453 discusses how to use ODBC with Microsoft Query '97.

- Appendix H, "The UNIX Environment," on page 457 explains the structure of the *system information file* (used in the UNIX environment), provides a sample system information file, and discusses UNIX environment variables.

If you are writing programs to access ODBC drivers, you need to obtain a copy of the *ODBC Programmer's Reference* for the Microsoft Open Database Connectivity Software Development Kit, available from Microsoft Corporation.

For the latest information about the specific DataDirect drivers available for your platform, see the README file in your software package, or refer to the MERANT World Wide Web page at:

http://www.merant.com

Conventions Used in This Manual

This reference uses the following typographical conventions:

Convention	Explanation
italics	Introduces new terms with which you may not be familiar, and is used occasionally for emphasis.
bold	Emphasizes important information. Also indicates button, menu, and icon names on which you can act. For example, click **Next**.
UPPERCASE	Indicates the name of a file. For operating environments that use case-sensitive filenames, the correct capitalization is used in information specific to those environments. Also indicates keys or key combinations that you can use. For example, press the ENTER key.
`monospace`	Indicates syntax examples, values that you specify, or results that you receive.
`monospaced italics`	Indicates names that are placeholders for values that you specify. For example, *`filename`*.
forward slash /	Separates menus and their associated commands. For example, Select File / Copy means that you should select Copy from the File menu. The slash also separates directory levels when specifying locations under UNIX.
vertical rule |	Indicates an "OR" separator used to delineate items.
brackets [ ]	Indicates optional items. For example, in the following statement: SELECT [DISTINCT], DISTINCT is an optional keyword. Also indicates sections of the Windows Registry.
braces { }	Indicates that you must select one item. For example, {yes | no} means that you must specify either yes or no.

Convention	Explanation
ellipsis . . .	Indicates that the immediately preceding item can be repeated any number of times in succession. An ellipsis following a closing bracket indicates that all information in that unit can be repeated.

Mouse Conventions

This action…	Means to…
Click	Point to an object with the mouse pointer and momentarily press the left mouse button.
Double-click	Press the left mouse button twice.
Right-click	Momentarily press the right mouse button.
Drag	Press and hold the left mouse button while dragging item(s) to another part of the screen.
SHIFT+Click	Click an object to select it; then, press and hold the SHIFT key. Click another object to select the intervening series of objects.
CTRL+Click	Press and hold the CTRL key; then, click a selection. This lets you select or deselect any combination of objects.

Keyboard Conventions

Select menu items by using the mouse or pressing ALT+ the key letter of the menu name or item.

Environment-Specific Information

This manual pertains to Connect ODBC drivers for use under the following 32-bit operating environments:

Microsoft	Windows 9*x* and Windows NT
UNIX	AIX, HP-UX, and Solaris

Unless otherwise noted, information in this manual applies to all of the Windows environments. Wherever information is provided that is not applicable to all supported environments, the following symbols are used to identify that information:

The Windows symbol signifies text that is applicable only to Windows.

UNIX

The UNIX symbol signifies text that is applicable only to UNIX.

This manual shows dialog boxes that are specific to Windows 9*x*. If you are using the drivers on Windows NT, the dialog box that you see may differ slightly from the Windows 9*x* version. If you are using a graphical user interface in the UNIX environment, you will see a dialog box for logon, but not for driver configuration.

Documentation

This Reference and the *DataDirect Connect ODBC Installation Guide* are available on the DataDirect CD as online books in Adobe Acrobat PDF format. These PDF books are also available on the MERANT World Wide Web site when you purchase Connect ODBC products there. You can view and print these books using Acrobat Reader, version 3.0 or higher, licensed from Adobe Systems. The CD includes Acrobat Reader version 3.0 for most platforms. You can also download the Acrobat Reader software from the Adobe Web site at no charge. The Adobe URL address is:

http://www.adobe.com/prodindex/acrobat/readstep.html

The instructions for installing the Online Documents and the Acrobat Reader from the DataDirect CD are provided in the insert that accompanies the CD. This insert and the Adobe Web site also provide a complete list of the system requirements for Acrobat Reader on Windows 3.1*x*, Windows 9*x*, Windows NT, and UNIX platforms.

UNIX

Note: To use the Acrobat Reader on UNIX, your system must be running one of the window managers required by Adobe.

The *DataDirect Connect ODBC Reference* is also available in bound hardcopy; see "Ordering Hard-Copy Manuals" on page 25 for how to order.

Driver system requirements for connecting to data sources can be found in the *DataDirect Connect ODBC Reference* and in the online help. Your system must meet these requirements before you can install and use a driver successfully.

On Windows platforms, online help is provided through the Help button on the Driver Setup windows and through a general ODBC driver help file, installed in the Connect ODBC program group, that can be accessed separately.

UNIX

On UNIX platforms, online help for driver configuration is provided through a help file in PDF format, viewed with Acrobat Reader version 3.0. This file is installed as /doc/odbchelp.pdf.

Ordering Hard-Copy Manuals

As part of your license agreement, you may print and distribute as many copies of the manuals as needed.

If you do not want to print each of these online manuals, you can order hard-copy versions from MERANT. To order, please complete the following order form and fax your request to MERANT at (919) 461-4526.

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Manual Title	Price	Quantity	Total
DataDirect Connect ODBC Installation Guide	$35.00		
DataDirect Connect ODBC Reference	$35.00		

Shipping: Orders are shipped via Standard Airborne delivery from our Rockville Distribution Center. Items should arrive within 5 business days of receipt of order.

Contacting Technical Support

MERANT provides technical support for all registered users of Integrator, including limited installation support, for the first 30 days. For support after that time, contact us using one of the following methods or purchase further support by enrolling in the SupportNet program. For more information about SupportNet, contact your sales representative.

The MERANT Web site provides the latest support information through SupportNet Online, our global service network that provides access to valuable tools and information. Our SupportNet users access information using the Web, automatic email notification, newsgroups, and regional user groups. SupportNet Online includes a knowledge base that allows you to search on keywords for technical bulletins and other information. You also can download product fixes for your DataDirect products.

World Wide Web

http://www.merant.com/datadirect/support

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Spain	900 968 929	9:00 a.m.-6:30 p.m. CET
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USA and Canada	1 800 443 1601	8:30 a.m.-8:00 p.m. EST

* Abbreviations: CET—Central European Time; EST—Eastern Standard Time; GMT—Greenwich Mean Time; JST—Japanese Standard Time; LMT—Local Melbourne Time.

International Telephone Support

English-speaking support	+44 1727 811122	9:00 a.m.-6:30 p.m. CET
French-speaking support	+44 1727 811289	9:00 a.m.-6:30 p.m. CET
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* Abbreviation: CET—Central European Time

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When you contact us, please provide the following information:

- The **product serial number** located on the Product Registration Information card or on a product serial number card in your package. The number will be checked to verify your support eligibility. If you do not have a SupportNet contract, we will ask you to speak with a sales representative.
- Your **name and organization.** For a first-time call, you may be asked for full customer information, including location and contact details.
- The **version number** of your DataDirect product.
- The type and version of your **operating system**.
- Any **third-party software or other environment information** required to understand the problem.
- A **brief description of the problem,** including any error messages that you have received, **and the steps preceding the occurrence of the problem**. Depending on the complexity of the problem, you may be asked to submit an example so that we can recreate the problem.
- An assessment of the **severity level** of the problem.

1 Getting Started

This chapter contains the following sections:

- About DataDirect Connect ODBC Drivers
- Environment-Specific Information
- Error Messages

About DataDirect Connect ODBC Drivers

The *drivers* that make up MERANT DataDirect Connect ODBC are compliant with the Open Database Connectivity (ODBC) specification. ODBC is a specification for an application program interface (API) that enables applications to access multiple database management systems using Structured Query Language (SQL).

ODBC permits maximum interoperability—a single application can access many different database management systems. This enables an ODBC developer to develop, compile, and ship an application without targeting a specific type of data source. Users can then add the database drivers, which link the application to the database management systems of their choice.

DataDirect provides ODBC drivers for both relational and flat-file database systems. The flat-file drivers provide full SQL support; see Appendix A, "SQL for Flat-File Drivers," on page 377 for details.

Support for Multiple Environments

DataDirect provides ODBC-compliant database drivers for the Windows 9*x* and Windows NT platforms, as well as for the following UNIX platforms: Solaris for SPARC, HP-UX, and AIX.

Note: Database drivers are continually being added to each operating environment. See the README file shipped with your DataDirect product for an up-to-date list of drivers and for current driver information.

Network protocol requirements vary, depending on the database drivers that you use. To connect to a relational database system, you need the appropriate network software from the database vendor. See the "System Requirements" section in the appropriate driver chapter for additional information.

"Environment-Specific Information" on page 33 explains the environment-specific differences of which you should be aware when using the database drivers in your operating environment.

Installing the ODBC Drivers

The DataDirect Connect ODBC drivers are installed by the Setup program for the product with which they are shipped. For instructions on running the Setup program, see the Installation Guide that accompanies the product.

Environment-Specific Information

The following topics contain information specific to your operating environment, such as filenames and system requirements.

For Windows 9*x* and Windows NT Users

On Windows 9*x* and Windows NT systems, the ODBC drivers are 32-bit drivers. All required network software supplied by your database system vendors must be 32-bit compliant. The "System Requirements" section lists specific requirements for each relational database driver.

Starting the ODBC Administrator

The "Configuring Data Sources" section in each driver chapter instructs you to start the ODBC Administrator. To start the ODBC Administrator under Windows 9*x* or Windows NT, double-click the ODBC icon in the Windows 9*x* or Windows NT Control Panel.

Driver Names

The prefix for all Connect ODBC driver filenames on Windows 9*x* and Windows NT is "IV." The file extension is .DLL. This indicates that they are dynamic link libraries. For example, the Oracle7 driver filename is IVOR7*nn*.DLL, where *nn* is the revision number of the driver.

See the README file shipped with your DataDirect product for the filename of each driver supported on Windows 9*x* and Windows NT.

Disk Space and Memory Requirements

Disk space requirements are 25 MB of free disk space on the disk drive where Windows 9*x* or Windows NT is installed.

Memory requirements vary, depending on the database driver. If you are using a flat-file database driver, you need at least 8 MB of memory on Windows 9*x* or at least 16 MB of memory on Windows NT. If your system is hosting a relational database system, additional memory may be required. Consult your relational database documentation to determine the exact memory requirements.

For UNIX Users

Consult the "System Requirements" section of each database driver chapter. The following UNIX platforms are supported.

AIX

The ODBC drivers for AIX are supported on AIX 4.21 and AIX 4.3. They are not supported on AIX 4.20.

The AIX ODBC drivers are only compatible with C++ built applications. Two versions of the ODBC drivers for AIX are provided. The default AIX ODBC drivers are for use only with reentrant C++ applications (applications built using an IBM reentrant C++ compiler such as xlC_r).

Non-reentrant AIX ODBC drivers are provided in the "nothread" subdirectory created during the AIX ODBC driver installation.

These non-reentrant AIX ODBC drivers are for use only with non-reentrant C++ applications (applications built using a regular non-reentrant IBM C++ compiler such as xlC).

Note that the "nothread" directory is not a complete ODBC installation. It contains only the files required to replace the reentrant counterparts.

To replace the default ODBC files with the non-reentrant versions, change to the ODBC installation directory and execute the following:

```
cd nothread
cp -R * ..
```

HP-UX aCC

The ODBC drivers for HP-UX aCC are supported on HP-UX 10.20 or higher when running with HP-UX applications built using the HP aCC compiler version 1.12 or higher.

Note: The ODBC drivers for HP-UX aCC are supported on HP-UX 11.0 provided the application using the ODBC drivers was built on HP-UX 10 using aCC 1.12 or higher. The ODBC drivers for HP-UX aCC are not supported when running with native HP-UX 11 applications.

The ODBC drivers require certain runtime library patches. The patch numbers are listed in the READ.ME file for your product. HP-UX patches are publicly available from the HP Web site (www.hp.com) or FTP site (i3107ffs.external.hp.com).

HP updates the patch database regularly; therefore, the patch numbers in the README file may be superseded by newer versions. If you search for any of the specified patches on an HP site and receive a message that a patch has been superseded, download and install the replacement patch.

HP-UX 11 aCC Only

The ODBC drivers for HP-UX 11 aCC are supported on HP-UX 11.0 or higher when running with HP-UX applications built using the HP aCC compiler version 3.05 or higher.

The ODBC drivers require certain runtime library patches. The patch numbers are listed in the READ.ME file for your product. HP-UX patches are publicly available from the HP Web site (www.hp.com) or FTP site (i3107ffs.external.hp.com).

HP updates the patch database regularly; therefore, the patch numbers in the README file may be superseded by newer versions. If you search for the specified patch on an HP site and receive a message that the patch has been superseded, download and install the replacement patch.

HP-UX cFront

The ODBC drivers for HP-UX cFront are supported on HP-UX 10.10.36 or higher when running with HP-UX applications built using the HP cFront compiler. HP-UX 10.10 users must have a patch revision level of 36 or above.

Solaris

The ODBC drivers for Solaris are supported on Solaris 2.5.1 and higher, including Solaris 2.6 and Solaris 7, and on SunOS 5.5.1 and higher, including SunOS 5.6 and 5.7.

The System Information File (.odbc.ini)

In the UNIX environment, there is no ODBC Administrator. To configure a data source, you must edit the system information file, a plain text file that is normally located in the user's $HOME directory and is usually called *.odbc.ini*. This file is maintained using any text editor to define data source entries as described in the "Connecting to a Data Source Using a Connection String" section of each driver's chapter. A sample file (odbc.ini) is located in the driver installation directory.

Appendix H, "The UNIX Environment," on page 457 explains the structure of the system information file, provides a sample file, and discusses UNIX environment variables.

Driver Names

The Connect ODBC drivers are ODBC API-compliant dynamic link libraries, referred to in UNIX as *shared objects*. The prefix for all ODBC driver filenames on UNIX is "iv." On UNIX, the driver filenames are lowercase and the extension is .so or .sl. This is the standard form for a shared object. For example, the Oracle driver filename is ivor7*nn*.so, where *nn* is the revision number of the driver.

Note: The convention in this manual is to list the driver names in uppercase with the extension .DLL.

See the README file shipped with your DataDirect product for the filename of each driver supported on UNIX.

Setting the Library Path Environment Variable

You must include the full path to the dynamic link libraries in the environment variable LD_LIBRARY_PATH (on Solaris), LIBPATH (on AIX), and SHLIB_PATH (on HP-UX). For example, if you install the ODBC drivers in the system directory /opt/odbc, then the fully qualified path for the ODBC Pack is /opt/odbc/lib. During installation, a shell startup script is created and stored in the odbc directory. This shell script sets up the odbc environment for you.

For C shell users, the shell startup script is called odbc.csh. This script can be sourced from a user's own .login script. For example:

```
source /opt/odbc/odbc.csh
```

For Bourne or Korn shell users, the shell startup script is called odbc.sh. This script can also be sourced from a user's own .profile script. For example:

```
.  /opt/odbc/odbc.sh
```

If you do not include the path /opt/odbc/lib in the environment variable LD_LIBRARY_PATH (on Solaris), LIBPATH (on AIX), and SHLIB_PATH (on HP-UX), then your applications are unable to load the ODBC drivers dynamically at runtime or to display error message text.

Setting the Database Environment

In addition to setting the environment variables required by your particular database client, you must also add the client's library directory to your shared library path. For example, to add the INFORMIX lib directory /db/informix/lib to the shared library path under Solaris, C shell users would enter:

```
setenv LD_LIBRARY_PATH /db/informix/lib:${LD_LIBRARY_PATH}
```

Bourne or Korn shell users would use:

```
LD_LIBRARY_PATH=/db/informix/lib:$LD_LIBRARY_PATH
export LD_LIBRARY_PATH
```

See Appendix H, "The ivtestlib Tool," for information on diagnostic procedures using the ivtestlib tool.

Disk Space and Memory Requirements

Disk space requirements are 25 MB (40 MB on AIX) of free disk space on the disk where the UNIX system is installed.

Memory requirements vary, depending on the database driver. If you are using a flat-file database driver, you need at least 8 MB of memory. If your system will host a relational database system, additional memory will be required. Consult your relational database documentation to determine the exact memory requirements.

Error Messages

Error messages can come from:

- An ODBC driver
- The database system
- The ODBC driver manager

An error reported on an ODBC driver has the following format:

[*vendor*] [*ODBC_component*] *message*

ODBC_component is the component in which the error occurred. For example, an error message from the MERANT SQL Server 6 driver would look like this:

```
[MERANT] [ODBC SQL Server 6 driver] Invalid
precision specified.
```

If you receive this type of error, check the last ODBC call made by your application for possible problems or contact your ODBC application vendor.

An error that occurs in the data source includes the data source name, in the following format:

[*vendor*] [*ODBC_component*] [*data_source*] *message*

With this type of message, *ODBC_component* is the component that received the error from the data source indicated. For example, you may receive the following message from an Oracle data source:

```
[MERANT] [ODBC Oracle driver] [Oracle] ORA-0919:
specified length too long for CHAR column
```

If you receive this type of error, something is incorrect regarding the database system. Check your database system documentation for more information or consult your database administrator. In this example, you would check your Oracle documentation.

The driver manager is a DLL that establishes connections with drivers, submits requests to drivers, and returns results to applications. An error that occurs in the driver manager has the following format:

[*vendor*] [ODBC XXX] *message*

For example, an error from the Microsoft driver manager might look like this:

```
[Microsoft] [ODBC Driver Manager] Driver does not
support this function
```

If you receive this type of error, consult the Programmer's Reference for the Microsoft ODBC Software Development Kit available from Microsoft.

UNIX Error Handling

UNIX error handling follows the X/Open XPG3 messaging catalog system. Localized error messages are stored in the subdirectory locale/*localized_territory_directory*/LC_MESSAGES, where *localized_territory_directory* depends on your language.

For instance, German localization files are stored in locale/de/LC_MESSAGES, where de is the locale for German.

If localized error messages are not available for your locale, then they will contain message numbers instead of text. For example:

```
[MERANT] [ODBC 20101 driver] 30040
```

2 Connect ODBC for Btrieve (Pervasive.SQL)

Connect ODBC for Btrieve (the "Btrieve driver") supports Btrieve version 6.15 and higher and Pervasive.SQL 7.0 under the Windows 9*x* and Windows NT environments. The driver executes SQL statements directly on Btrieve databases.

See the README file shipped with your DataDirect product for the file name of the Btrieve driver.

System Requirements

To access a Btrieve database, you must be using either Btrieve 6.15 or Pervasive.SQL 7.0 for Windows NT or Windows 9*x*.

Before you attempt to access Btrieve files, you must incorporate existing Btrieve files into a Scalable SQL database. See "Defining Table Structure" on page 51 for more information.

Note: The Btrieve driver may experience problems if the Btrieve Microkernel Engine's communication buffer size is smaller than the Btrieve driver's Array Size attribute. You can increase the communication buffer size with the Pervasive Software Setup Utility. You can decrease the array size option when you configure a data source using the ODBC Btrieve Driver Setup dialog box, or when passing a connection string.

Managing Databases

If you already use Scalable SQL, the Btrieve driver can access your Scalable SQL databases directly. If not, your Btrieve files must be incorporated into a Scalable SQL database.

A Scalable SQL database is composed of data files that contain your records and data dictionary files that describe the database. The data files are Btrieve files. The data dictionary files are special Btrieve files that contain descriptions of the data files, views, fields, and indexes in your database.

All Btrieve files in a Scalable SQL database must reside in the same directory. In addition to the Btrieve data files, the three data dictionary files (FILE.DDF, FIELD.DDF, and INDEX.DDF) also must be in the directory.

Incorporating a Btrieve file into a Scalable SQL database does not change the Btrieve file in any way. You can continue to access the file directly with any existing Btrieve application.

Transactions

The Btrieve driver supports *transactions*. A transaction is a series of database changes that is treated as a single unit. In applications that don't use transactions, the Btrieve driver immediately executes Insert, Update, and Delete statements on the database files and the changes are automatically committed when the SQL statement is executed. You cannot undo these changes. In applications that use transactions, the Btrieve driver holds inserts, updates, and deletes until you issue a Commit or Rollback. A Commit saves the changes to the database file; a Rollback undoes the changes.

Transactions affect the removal of record locking. All locks are removed when SQLTransact is called with the Commit or Rollback option to end the active transaction.

To use the Btrieve driver's transaction processing capabilities, consult the Pervasive documentation.

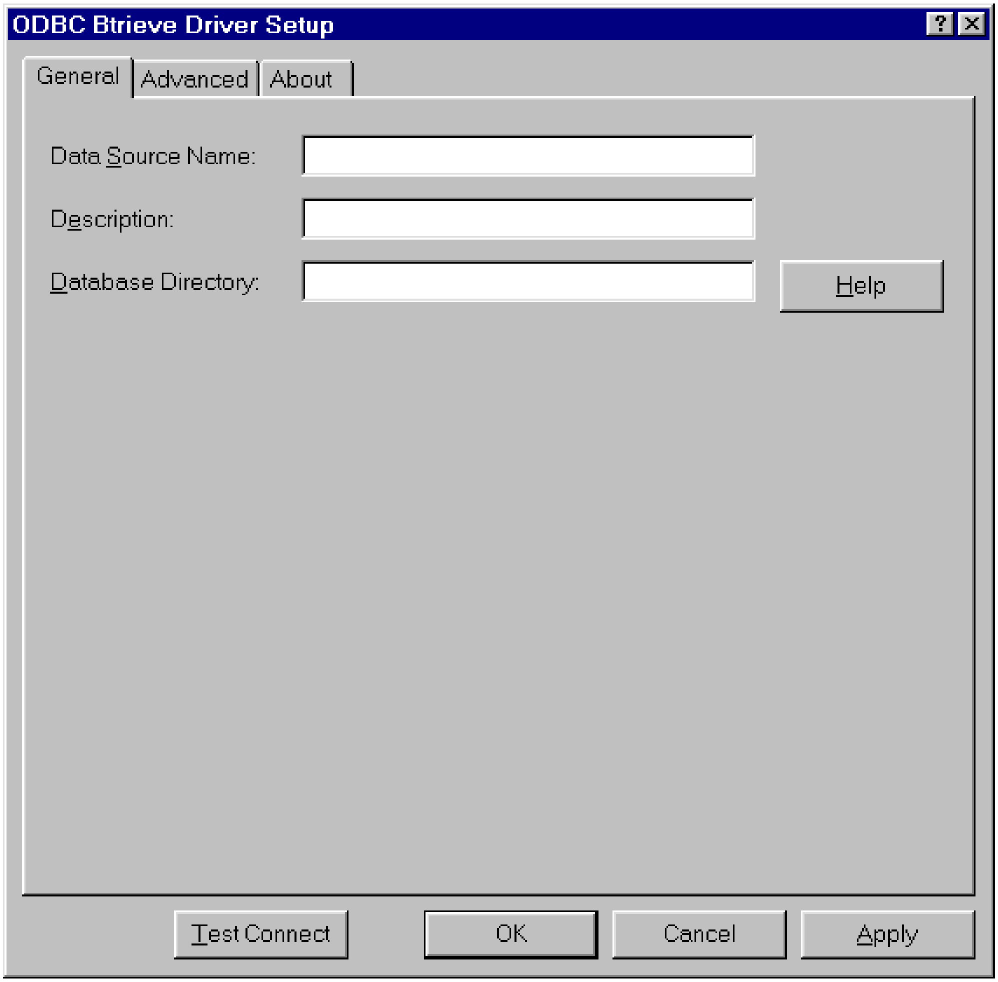
Configuring Data Sources

Data sources are configured and modified through the ODBC Administrator. To configure a Btrieve data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Btrieve Driver Setup dialog box.

If you are configuring a new data source, click **Add.** A list of installed drivers appears. Select the Btrieve driver and click **Finish** to display the ODBC Btrieve Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

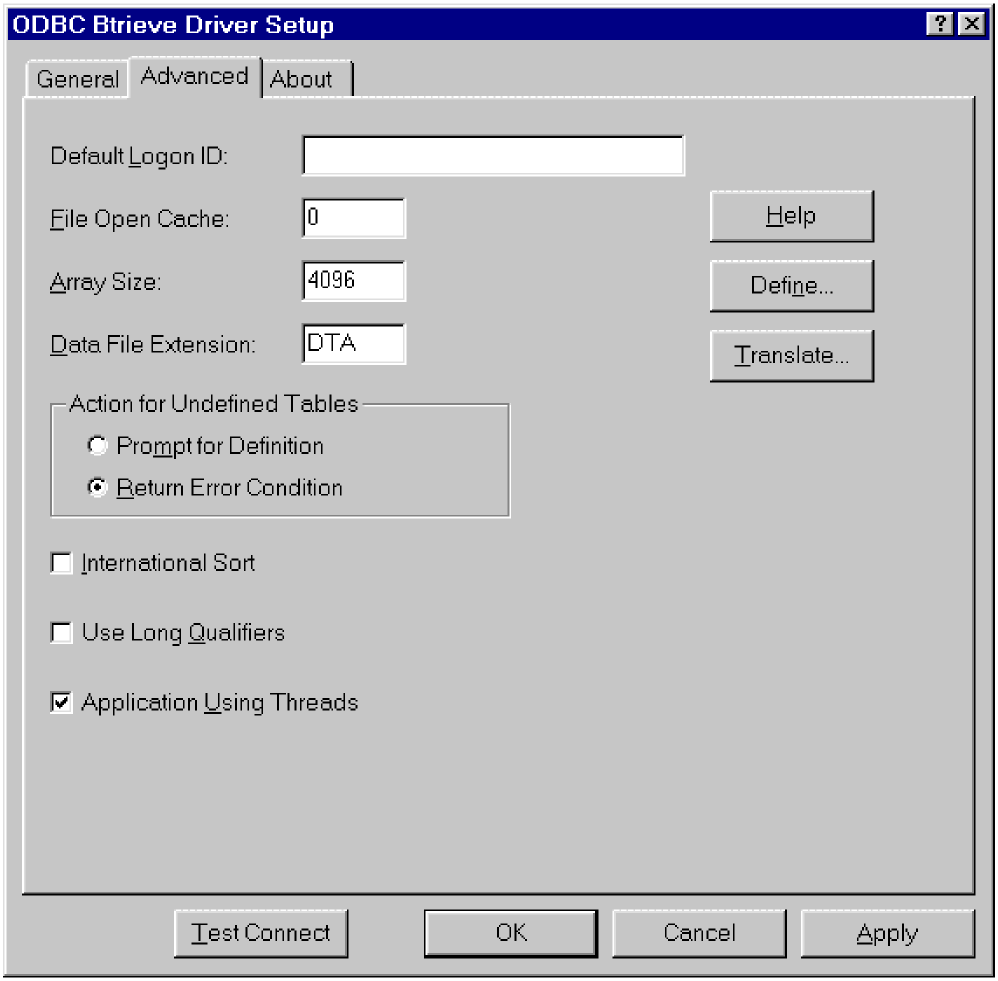
4 Specify values for the following; then, click **Apply**:

Data Source Name: A string that identifies this Btrieve data source configuration in the system information. Examples include "Accounting" or "Btrieve Files."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "Btrieve files in C:\ACCOUNTS."

Database Directory: The full pathname of the directory that contains the Btrieve files and the data dictionary files (.DDF). Data dictionary files describe the structure of Btrieve data. If no directory is specified, the current working directory is used.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

Default Logon ID: The default logon ID used to connect to your Btrieve database. A logon ID is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in a connection string.

File Open Cache: A numeric value to specify the maximum number of used file handles to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The disadvantage is that a user who specifies file locking on open may get a locking conflict even though no one appears to have the file open. The default is 0, which means no file open caching.

Array Size: A value that enables the driver to retrieve an array of records from the Btrieve engine and in most cases results in better performance for the application. The Array Size value is the number of bytes in the array. The default value is 4,096 bytes, and the maximum is 65,535 bytes.

Data File Extension: A string of three or fewer characters that specifies the file extension to use for data files. The default value is DTA. This value is used for all Create Table statements. Sending a Create Table statement that uses an extension other than the one specified as the DataFileExtension value causes an error.

In other SQL statements, such as Select or Insert, you can specify an extension other than the DataFileExtension value. If you do not specify an extension value in these cases, the DataFileExtension value is used.

Action for Undefined Tables: A setting to indicate whether the driver should prompt the user when it encounters a table for which it has no structure information. Select the Prompt for Definition radio button to prompt the user; select the Return Error Condition radio button (the default) to return an error.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Use Long Qualifiers: A setting that specifies whether the driver uses long path names. If you select the Use Long Qualifiers check box, path names can be up to 255 characters. If the check box is cleared (the default), the maximum path name length is 128 characters.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread-safety standards.

Define: Click **Define** to define table structure. See "Defining Table Structure" for step-by-step instructions.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

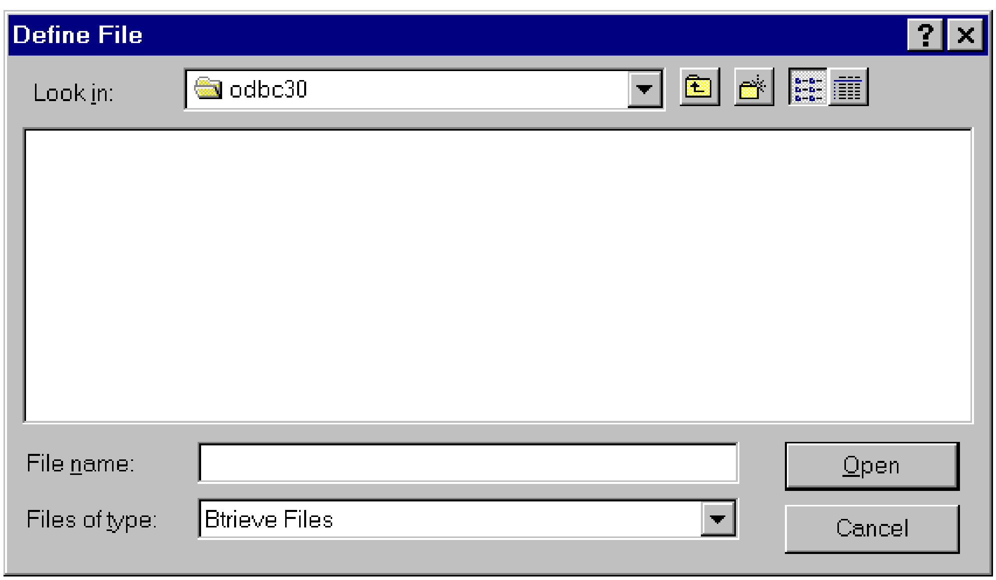
7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Defining Table Structure

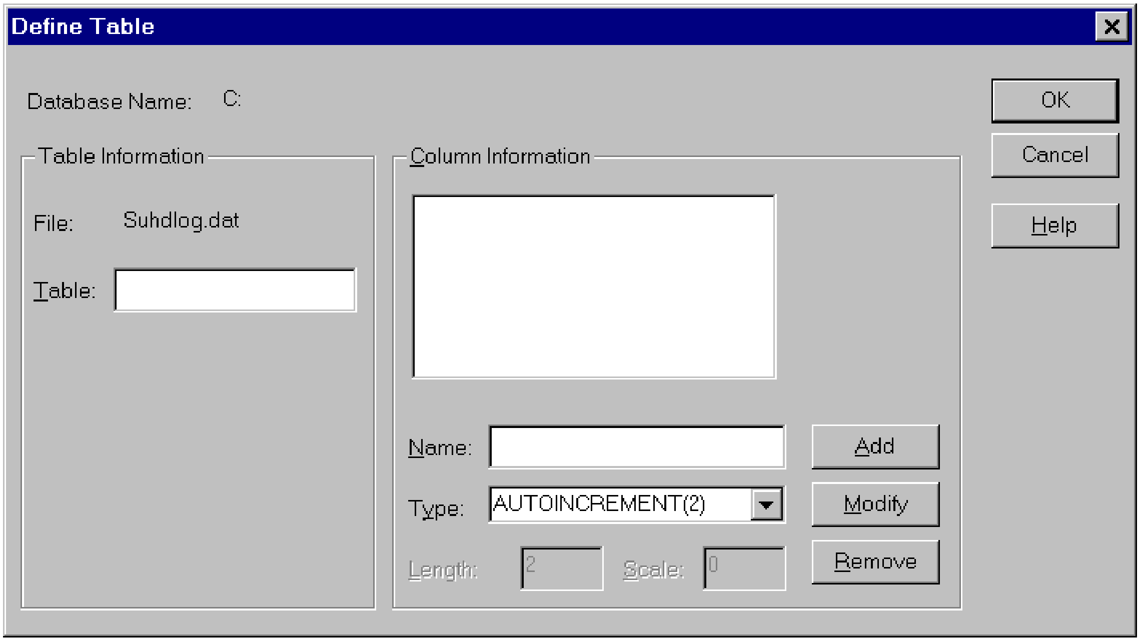
Because Btrieve does not store any column information in the data file, you may need to define its structure. Tables created by the DataDirect driver or by Scalable SQL will not require this. Utilities are also available from Pervasive that will perform this operation.

To define the structure of a file:

1 Display the ODBC Btrieve Driver Setup dialog box through the ODBC Administrator. Click the **Advanced** tab; then, click **Define** to display the Define File dialog box.



2 Select the file you want to define and click **Open** to display the Define Table dialog box.



Database Name: The name of the Scalable SQL data dictionary directory that you selected in the Define File dialog box.

File: The name of the file that you selected in the Define File dialog box.

Table: Type the name of the table to be returned by SQLTables. The name can be up to 20 characters and cannot be the same as another defined table in the database. This field is required.

3 Enter values in the following fields to define each column. Click **Add** to add the column name to the list box.

Name: Type the name of the column.

Type: Select the data type of the column.

Length: Type the length of the column, if applicable.

Scale: Type the scale of the column, if applicable.

4 To modify an existing column definition, select the column name in the list box. Modify the values for that column name; then, click **Modify**.

5 To delete an existing column definition, select a column name in the list box and click **Remove**.

6 Click **OK** to define the table.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Btrieve is:

```
DSN=BTRIEVE FILES;DB=J:\Btrvdata
```

Table 2-1 lists the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 2-1. Btrieve Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread-safety standards.
ArraySize (AS)	An integer value that enables the driver to retrieve an array of records from the Btrieve engine and in most cases results in better performance for the application. The value of ArraySize is the number of bytes in the array. The default ArraySize is 4,096 bytes and the maximum is 65,535 bytes.
Database (DB)	The full pathname of the directory that contains the Btrieve files and the data dictionary files (.DDF). Data dictionary files describe the structure of Btrieve data. If no directory is specified, the current working directory is used.
DataFileExtension (DFE)	A string of three or fewer characters that specifies the file extension to use for data files. The default value is DTA. This value is used for all Create Table statements. If you execute a Create Table statement that uses an extension other than the one specified as the DataFileExtension value, an error occurs. In other SQL statements, such as Select or Insert, you can specify an extension other than the DataFileExtension value. If you do not specify an extension value in these cases, the DataFileExtension value is used.

Table 2-1. Btrieve Connection String Attributes (cont.)

Attribute	Description
DataSourceName (DSN)	A string that identifies a Btrieve data source configuration in the system information. Examples include "Accounting" or "Btrieve Files."
DeferQuery Evaluation (DQ)	DeferQueryEvaluation={0 | 1}. This attribute determines when a query is evaluated—after all records are read or each time a record is fetched. If DeferQueryEvaluation=0, the driver generates a result set when the first record is fetched. The driver reads all records, evaluates each one against the Where clause, and compiles a result set containing the records that satisfy the search criteria. This process slows performance when the first record is fetched, but activity performed on the result set after this point is much faster because the result set has already been created. You do not see any additions, deletions, or changes in the database that occur while working with this result set. If DeferQueryEvaluation=1 (the default), the driver evaluates the query each time another record is fetched and stops reading through the records when it finds one that matches the search criteria. This setting avoids the slowdown while fetching the first record, but each fetch takes longer because of the evaluation taking place. The data you retrieve reflect the latest changes to the database; however, a result set is still generated if the query is a Union of multiple Select statements, if it contains the Distinct keyword, or if it has an Order By or Group By clause.

Table 2-1. Btrieve Connection String Attributes (cont.)

Attribute	Description
FileOpenCache (FOC)	An integer value that determines the maximum number of used file handles to cache. For example, when FileOpenCache=4, and a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of using file open caching is increased performance. The initial default is 0, which means no file open caching.
IntlSort (IS)	IntlSort={0 | 1}. This attribute determines the order that records are retrieved when you issue a Select statement with an Order By clause. If IntlSort=0 (the initial default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If IntlSort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.
LogonID (UID)	The default logon ID used to connect to your Btrieve database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID.
ModifySQL (MS)	ModifySQL={0 | 1}. This attribute is provided for backward compatibility. Specify ModifySQL=0 to have the driver understand SQL dialects found in earlier drivers. Specify ModifySQL=1 (the default) to have the driver modify the SQL statement to conform to ODBC specifications.

Table 2-1. Btrieve Connection String Attributes (cont.)

Attribute	Description
Password (PWD)	The password that you must enter if your Scalable SQL data dictionary files have security restrictions imposed.
UndefinedTable (UT)	UndefinedTable={PROMPT | ERROR}. This attribute determines whether the driver should prompt the user when it encounters a table for which it has no structure information. Set this option to PROMPT to prompt the user; set it to ERROR to return an error. The initial default is to return an error.
UseLongQualifiers (ULQ)	UseLongQualifiers={0 | 1}. This attribute specifies whether the driver uses long path names as table qualifiers. With UseLongQualifiers set to 1, path names can be up to 255 characters. The default is 0; maximum path name length is 128 characters.

Data Types

Table 2-2 shows how the Btrieve data types map to the standard ODBC data types. The Btrieve data types are used when you incorporate Btrieve files into a Scalable SQL database.

Table 2-2. Btrieve Data Types

Btrieve	ODBC
Autoincrement(2)	SQL_SMALLINT
Autoincrement(4)	SQL_INTEGER
Bfloat(4)	SQL_REAL
Bfloat(8)	SQL_DOUBLE
Bit	SQL_BIT

Table 2-2. Btrieve Data Types (cont.)

Btrieve	ODBC
Blob	SQL_LONGVARGBINARY
Char	SQL_CHAR
Currency	SQL_DECIMAL
Date	SQL_TYPE_DATE
Decimal	SQL_DECIMAL
Float(4)	SQL_REAL
Float(8)	SQL_DOUBLE
Integer(1)	SQL_TINYINT
Integer(2)	SQL_SMALLINT
Integer(4)	SQL_INTEGER
Integer(8)	SQL_BIGINT
Logical(1)	SQL_BIT
Logical(2)	SQL_BIT
Lstring	SQL_VARCHAR
Money	SQL_DECIMAL
Note	SQL_LONGVARCHAR
Numeric	SQL_NUMERIC
Numericsts	SQL_NUMERIC
Time	SQL_TYPE_TIME
Timestamp	SQL_TYPE_TIMESTAMP
Unsigned(1)	SQL_TINYINT
Unsigned(8)	SQL_BIGINT
Zstring	SQL_VARCHAR

Indexes

Note: If you define an index using the Btrieve driver, the index will not have the restrictions discussed here.

For query optimization, the Btrieve driver does not use the following:

- Indexes containing all-segment-null keys or any-segment-null keys.
- Any index key that is marked case-insensitive.
- Any index keys where the data type of the index key does not match the data type of the field. The one exception is if the index key is declared as an unsigned integer and the field in the file is declared as signed integer, or vice versa, then the driver assumes the field contains only unsigned quantities and uses the index. Note that this can lead to incorrect results if the field in fact does contain signed quantities.

The Btrieve driver only uses an alternate-collating-sequence (ASC) index key for equality lookups. Additionally, if an ASC key is part of a segmented index, the other index segments are not used for query optimization unless the Where clause contains an equality condition for the ASC key.

Column Names

Column names in SQL statements (such as Select and Insert) can be up to 20 characters long. If column names are in all lowercase, a combination of upper and lowercase, contain blank spaces, or are reserved words, they must be surrounded by the grave character (`) (ASCII 96). For example:

```
SELECT `name` FROM emp
```

Select Statement

You use the SQL Select statement to specify the columns and records to be read. Btrieve Select statements support all the Select statement clauses described in Appendix A. See Appendix A, "SQL for Flat-File Drivers," on page 377 for more information. This section describes the information that is specific to Btrieve.

Rowid Pseudo-Column

Each Btrieve record contains a special column named Rowid. This field contains a unique number that indicates the record's sequence in the database. You can use Rowid in Where and Select clauses.

Rowid is particularly useful when you are updating records. You can retrieve the Rowid of the records in the database along with the other field values. For example:

```
SELECT last_name, first_name, salary, rowid FROM emp
```

Then you can use the Rowid of the record that you want to update to ensure that you are updating the correct record and no other. For example:

```
UPDATE emp set salary = 40000 FROM emp WHERE rowid=21
```

The fastest way of updating a single row is to use a Where clause with the Rowid. You cannot update the Rowid column.

Select statements that use the Rowid pseudo-column in the Where clause achieve maximum performance only for exact equality matches. If you use range scans instead of exact equality matches, a full table scan is performed. For example:

```
SELECT * FROM emp WHERE rowid=21    //fast search
SELECT * FROM emp WHERE rowid <=25  //full table scan
```

Alter Table Statement

The Btrieve driver supports the Alter Table statement to add one or more columns to a table or to delete (drop) a single column.

The Alter Table statement has the form:

```
ALTER TABLE table_name {ADD column_name data_type
| ADD (column_name data_type [, column_name
data_type]...)
| DROP [COLUMN] column_name}
```

table_name is the name of the table to which you are adding or dropping columns.

column_name assigns a name to the column you are adding or specifies the column you are dropping.

data_type specifies the native data type of each column you add.

For example, to add two columns to the emp table:

```
ALTER TABLE emp (ADD startdate date, dept char 10)
```

You cannot add columns and drop columns in a single statement, and you can drop only one column at a time. For example, to drop a column:

```
ALTER TABLE emp DROP startdate
```

The Alter Table statement fails when you attempt to drop a column upon which other objects, such as indexes or views, are dependent.

Create and Drop Index Statements

The Btrieve driver supports SQL statements to create and delete indexes. The Create Index statement is used to create indexes and the Drop Index statement is used to delete indexes.

Create Index

The Create Index statement for Btrieve files has the form:

```
CREATE [UNIQUE] INDEX index_name ON table_name
([field_name [ASC | DESC] [,field_name
[ASC | DESC]]...)
```

UNIQUE means that Btrieve does not let you insert two records with the same index values.

index_name is the name of the index.

table_name is the name of the table on which the index is to be created.

ASC tells Btrieve to create the index in ascending order. DESC tells Btrieve to create the index in descending order. By default, indexes are created in ascending order. For example:

```
CREATE INDEX lname ON emp (last_name)
```

Drop Index

The form of the Drop Index statement is

```
DROP INDEX table_name.index_name
```

table_name is the name of the table from which the index is to be dropped.

index_name is the name of the index.

For example:

```
DROP INDEX emp.lname
```

Isolation and Lock Levels Supported

Btrieve supports isolation level 1 (read committed) only. Btrieve supports record-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Btrieve driver. In addition, the following function is supported: SQLSetPos.

The Btrieve driver also supports backward and random fetching in SQLExtendedFetch and SQLFetchScroll. The driver supports the minimum SQL grammar with several core extensions.

Number of Connections and Statements Supported

Btrieve files support a single connection and multiple statements per connection.

3 Connect ODBC for DB2

Connect ODBC for DB2 (the "DB2 driver") supports the following database systems in the Windows NT, Solaris, HP-UX, and AIX environments:

- DB2 Universal Database for Windows NT
- DB2 Universal Database for UNIX
- DB2 for OS/390 [Connect Premium only]

See the README file shipped with your DataDirect product for the file name of the DB2 driver.

System Requirements

The server requirement for all platforms is the same. The DB2 Server must be installed as the Server Version (*not* the Local Version).

There is no client requirement for the DB2 driver.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 3-1. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

Users must create the bind packages on every server to which they intend to connect with the driver. The driver will not work properly with any server that does not have the packages created. The UNIX version of the driver is provided with a program that creates the bind package. It is the equivalent of the Create Package button on the Bind tab of the DB2 driver setup. (See Step 7 in this section.) To bind a package from a command shell, enter:

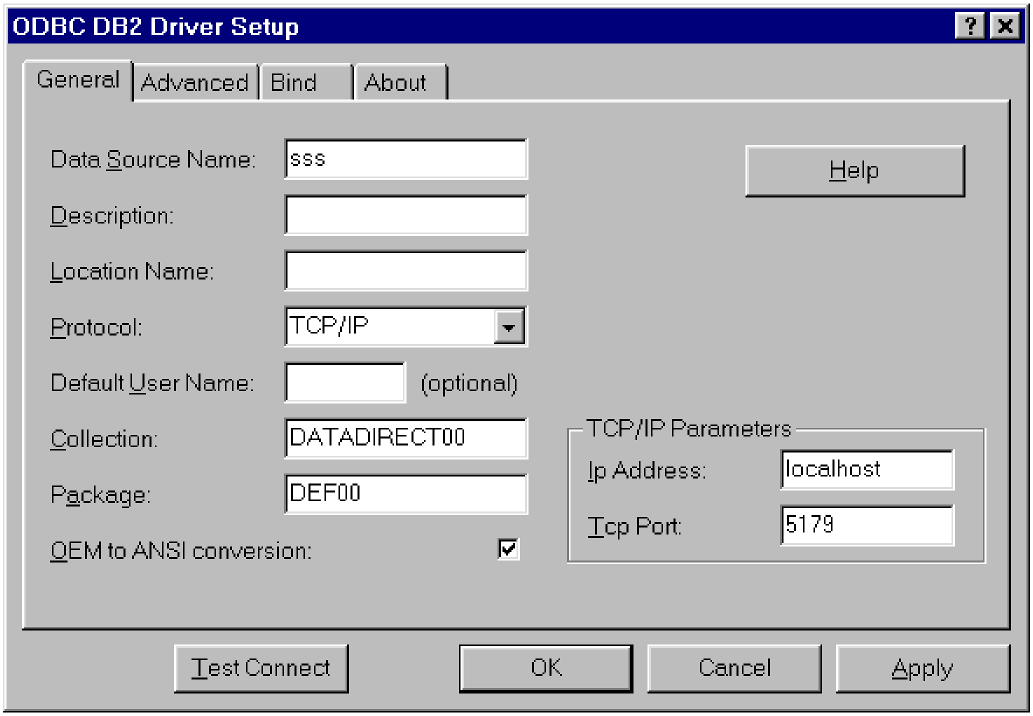
```
bind15 <dsn>
```

where dsn is the data source name. You are prompted for a user ID and password if they are not stored in the system information file.

To configure a DB2 data source under Windows:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC DB2 Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the DB2 driver and click **Finish** to display the ODBC DB2 Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 77 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this DB2 data source configuration in the system information. If you are creating a new data source definition, type a unique name of up to 32 characters. If you specify the name of an existing data source definition, the new settings will replace the existing ones.

IMPORTANT: To bind your application to a remote database using the Bind Utility, you must create a data source definition for the exclusive use of that application. Because the data source definition specifies the application's package name, only the application associated with that package is able to use the data source.

Description: Specifies an optional descriptive comment for this data source definition. ODBC-related applications and development tools often display this description with the data source name when they display a list of data sources. If you want to include a description for this data source definition, type a comment of up to 64 characters.

Location Name: Specifies the DB2 location name. Use the name defined during the local DB2 installation.

Protocol: Specifies the network protocol that the driver uses to communicate with the DB2 server. Select the protocol that this workstation will use (the workstation must have the hardware and software to support the selected protocol). The following protocols are supported by the driver:

- NETBIOS
- TCP/IP—If you select TCP/IP, complete the Ip Address and Tcp Port fields as follows:
  - In Ip Address, type the IP (Internet Protocol) address of the machine where the catalog tables are stored. Specify the address using the machine's numeric address (for example, 123.456.78.90) or specify its

address name. If you enter an address name, the driver must find this name (with the correct address assignment) in the HOSTS file on the workstation or in a DNS server.

- In Tcp Port, type the port number that is assigned to the DB2 server on the machine where the catalog tables are stored. Specify either this port's numeric address or its name (8898 is the default port address). If you specify a port name, the driver must find this name (with the correct port assignment) in the SERVICES file on the workstation.

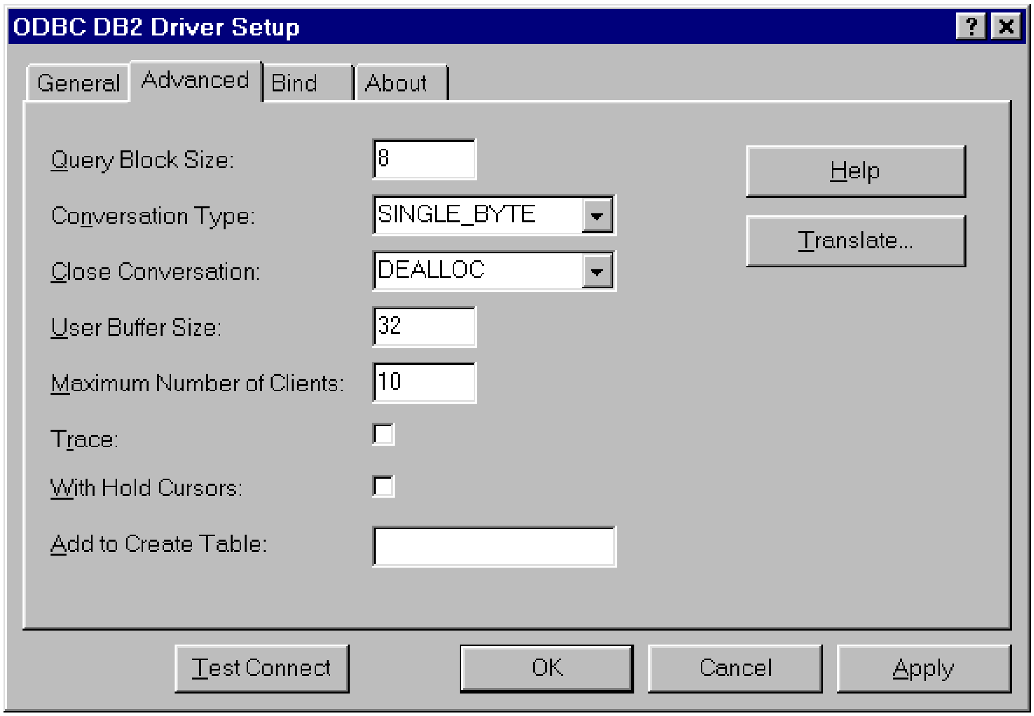
Default User Name: The default user name used to connect to your DB2 database. Your ODBC application may override this value or you may override it in the logon dialog box or connection string.

Collection: A name that identifies a group of packages. These packages include the Connect ODBC for DB2 driver packages. The default is DATADIRECT*xx* where *xx* is the version number.

Package: Specifies the name of the package that the driver uses to process static and dynamic SQL for applications that use this data source definition. The default name is DEF*xx* where *xx* is the version number.

OEM to ANSI conversion: Check this box to translate data from the IBM PC character set to the ANSI character set.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Query Block Size: Specifies the number of rows the driver retrieves when fetching from the server. This is not the number of rows given to the user. The default is 8 rows.

Conversation Type: Specifies the type of system codes used by DB2. This value indicates the byte format of character data in the command area of a DB2 packet sent from the remote host. The possible values are:

- Single Byte—Used if the remote host uses a single-byte system code page (as specified in DSNZPARMS on DB2/MVS, for example).

- Mixed Byte—Used if the remote host is DB2 3.1 and DSNZPARMS specifies a double-byte code page where single-byte and mixed-byte values are not allowed.

Close Conversation: Determines when the DB2 driver closes an LU 6.2 conversation. The possible values are:

- At Dealloc—Conversation is closed when the client application terminates.
- At Commit—Conversation is closed after the client application executes a COMMIT statement.

Use the default value At Dealloc unless you are tuning the system for OLTP applications, or you want to prevent an application from using host resources when a client leaves it idle for an extended period of time.

User Buffer Size: Specifies the size (in kilobytes) of the bulk packet that the DB2 driver uses to download data from the host. Permitted values are 1 to 63. For most environments, the default value of 32 is sufficient; however, adjusting the value can optimize some client applications as follows:

- For client applications that frequently download large amounts of data, a large buffer size can improve response time.
- For client applications that perform brief online transactions, a small buffer will maximize memory on the machine where the DB2 driver is installed.

Maximum Number of Clients: Specifies the maximum number of concurrent client sessions that the DB2 driver can carry. If the driver is used with an application server, select a value that will accommodate the number of users who will simultaneously access the host system through the DB2 driver. In a client configuration, use a small value to reduce the DB2 driver's memory requirements (unused client sessions needlessly consume memory on your machine). The default is 10.

Trace: When checked, generates a trace file in the driver directory that contains error information. The file is generated only if an error actually occurs.

With Hold Cursors: Specifies the cursor behavior of the application package used with this data source definition. This setting affects the operation of both the Static Bind Administrator and the Connect ODBC for DB2 driver. Enable this option only if you have enabled static binding for this data source definition.

When With Hold Cursors is enabled, the Static Bind Administrator automatically adds the WITH HOLD clause to queries that it puts in the application's database resource module (DBRM). The WITH HOLD clause prevents DB2 from automatically closing the cursor when the application executes a COMMIT statement.

If you use this data source definition with an application package that was created using With Hold Cursors, you must also enable the With Hold Cursors option.

When With Hold Cursors is set, SQLGetInfo( ) will return SQL_CB_PRESERVE for SQL_COMMIT_CURSOR_BEHAVIOR. For information about this function, refer to the Microsoft ODBC API.

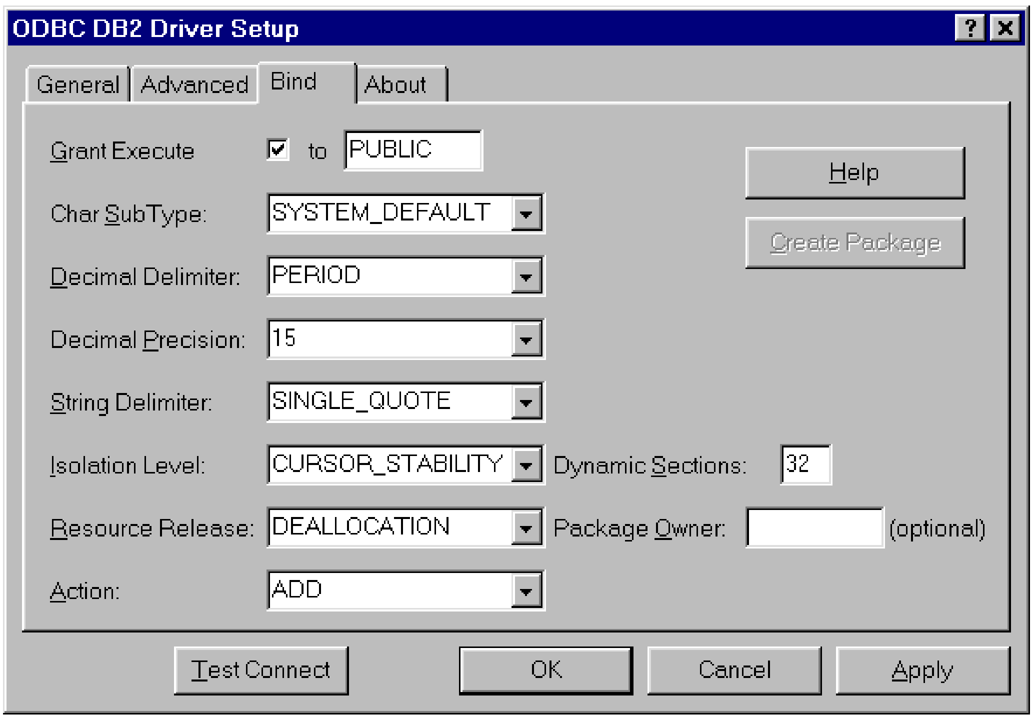
Add to Create Table: The string entered in this field is automatically added to all Create Table statements. This field is primarily for users who need to add an "in database" clause.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click the **Bind** tab to configure options for creating bind packages.

The Bind tab allows you to create dynamically the bind packages on the server that will be used by the driver. The tab also allows you to specify the behavior of the package. You must create the bind packages on every server to which you intend to connect with the driver. The driver will not work properly with any server that does not have the packages created.



8 Specify values for the following; then, click **Apply.**

Grant Execute: The check box indicates whether or not to grant privileges on the package that you are creating. The default value is grant execute privileges on the package to PUBLIC. You can also specify to whom to grant execute privileges.

Char Sub Type: Specifies the options for storing ambiguous character data in the database. The possible values are:

- System Default—Specifies system default value of the DB2 location to which you are binding.
- SBCS—Specifies a single-byte character set.
- MBCS—Specifies a mixed-byte character set.
- DBCS—Specifies a double-byte character set.

Decimal Delimiter: Specifies how the decimal point is represented. This is a required field if the DBRM file contains a decimal literal that does not match the host system's default value. The possible values are:

- Period—The decimal point is represented with a period, for example, 3.17. This is the default.
- Comma—The decimal point is represented with a comma, for example, 3,17.

Decimal Precision: Specifies the number of places following the decimal point that will be calculated. The possible values are:

- 0—system default value
- 15—15 decimal places (the default)
- 31—31 decimal places

String Delimiter: Specifies the type of quotation marks (single or double) used to represent constant string values that are referenced by the SQL in the DBRM. This option should match the option used to delimit the literal strings referenced by your embedded SQL. The default is single.

Isolation Level: Specifies the manner in which locks are acquired and released by the system. The possible values are:

- No Commit—Allows your program to read modified records even if they have not been committed by another person.
- Cursor Stability—Allows other processes to change a row that your application read, but does not change as long as your cursor is not on that row. Prevents other processes from changing records that your application has changed until your program commits them or terminates. Prevents your program from reading a modified record that has not been committed by another process. This is the default.
- Repeatable Read—Prevents other processes from changing records that are read or changed by your application (including phantom records) until your program commits them or terminates. Prevents the application from reading modified records that have not been committed by another process. If your program opens the same query during a single unit of work under this isolation level, the results table will be identical to the previous table; however, it can contain updates made by your program.

Resource Release: Specifies the release of database resources. Two options are available:

- Commit—Releases database resources after a commit and provides a high level of concurrency.
- Deallocation—Releases database resources when the connection is terminated. This is the default.

Action: Specifies the action to be taken by the system with a package. Two options are available:

- Replace—Replaces the existing package with a new package.
- Add—Creates a new package if one does not already exist. If one does exist, the bind process fails. This is the default.

Dynamic Sections: Specifies the number of statements that the DB2 driver package can prepare for a single user.

Package Owner: Specifies the AuthID assigned to the package. This DB2 AuthID must have authority to execute all the SQL in the package.

Create Package: Click to configure a package. Before you can use the DB2 driver, you must create a default DBRM for the link, and bind it to DB2. The default DBRM creates a package that the DB2 driver uses to execute dynamic SQL statements from your application.

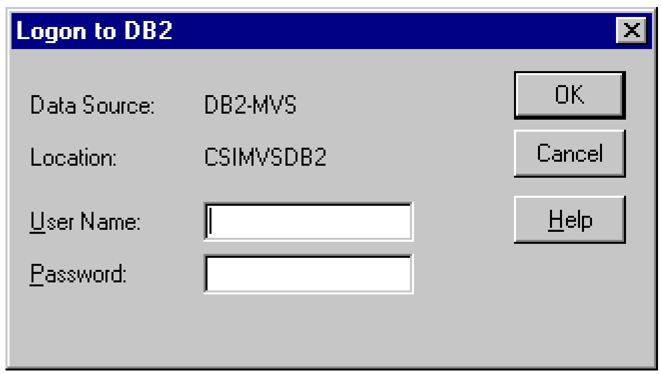
When you click the Create Package button, a logon dialog is displayed. Enter your user ID and password; then, click **Login**. A message is displayed indicating whether or not the package creation was successful.

Each time that you bind a DBRM, the Bind Utility creates a log file (.LOG) in which it records all errors that occur during the bind. The .LOG file is stored locally in the same directory as your DBRM (.DBR). If no error has occurred during the binding of a particular DBRM, the log file does not exist.

9 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For DB2, the dialog box is as follows:



In this dialog box, do the following:

1. If required, type your user name (authorization ID).
2. If required, type your password.
3. Click **OK** to complete the logon and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for DB2 is:

```
DSN=DB22 TABLES;DB=PAYROLL;UID=JOHN;PWD=XYZZY;GRP=ACCTNG
```

Table 3-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 3-1. DB2 Connection String Attributes

Attribute	Description
Action (ACT)	Action={ADD | REPLACE}. Specifies the package action to be taken by the system: Add—Creates a new package if one does not already exist. If one does exist, the bind process will fail. Replace—Replaces the existing package with a new package.
AddStringTo CreateTable (ASCT)	The string entered in this field is automatically added to all Create Table statements. This field is primarily for users who need to add an "in database" clause.
CharSubType Type (CST)	CharSubTypeType={SYSTEM_DEFAULT | SBCS | MBCS | DBCS}. System_Default specifies system default value of the DB2 location to which you are binding. SBCS specifies a single-byte character set. MBCS specifies a mixed-byte character set. DBCS specifies a double-byte character set.
Close Conversation (CC)	CloseConversation={DEALLOC | AT_COMMIT}. Determines when the DB2 driver closes an LU 6.2 conversation. The possible values are: At Dealloc—Conversation is closed when the client application terminates. At Commit—Conversation is closed after the client application executes a COMMIT statement. Use the default value At Dealloc unless you are tuning the system for OLTP applications, or you want to prevent an application from using host resources when a client leaves it idle for an extended period of time.

Table 3-1. DB2 Connection String Attributes *(cont.)*

Attribute	Description
Collection (COL)	A name that identifies a group of packages. These packages include the Connect ODBC for DB2 driver packages. The default is DATADIRECT*xx* where *xx* is the version number.
ConversationType (CT)	ConversationType={SINGLE_BYTE | MIXED_BYTE}. Specifies the type of system codes used by DB2. This value indicates the byte format of character data in the command area of a DB2 packet sent from the remote host. The possible values are: Single_Byte—Used if the remote host uses a single-byte system code page (as specified in DSNZPARMS on DB2/MVS, for example). Mixed_Byte—Used if the remote host is DB2 3.1 and DSNZPARMS specifies a double-byte code page where single-byte and mixed-byte values are not allowed.
DataSourceName (DSN)	A string that identifies a DB2 data source configuration in the system information. Examples include "Accounting" or "DB2-Serv1."
DecimalDelimiter (DD)	DecimalDelimiter={COMMA | PERIOD}. Specifies how the decimal point is represented. This is a required field if the DBRM file contains a decimal literal that does not match the host system's default value. The possible values are: Period—The decimal point is represented with a period, for example, 3.17. Comma—The decimal point is represented with a comma, for example, 3,17.
DecimalPrecision (DP)	DecimalPrecision={15 | 31}. Specifies the number of places following the decimal point that will be calculated. The possible values are: 0—system default value 15—15 decimal places 31—31 decimal places

***Table 3-1. DB2 Connection String Attributes** (cont.)*

Attribute	Description
DynamicSections (DS)	Specifies the number of statements that the DB2 driver package can prepare for a single user.
GrantAuthid (GA)	The default value is grant execute privileges on the package to PUBLIC. You can also specify to whom to grant execute privileges.
GrantExecute (GE)	GrantExecute={0 | 1}. Indicates whether or not to grant privileges on the package that you are creating. 1 grants privileges, 0 does not.
IpAddress (IP)	The IP (Internet Protocol) address of the machine where the catalog tables are stored. Enter the address using the machine's numeric address (for example, 123.456.78.90) or type its address name. If you enter an address name, the driver must find this name (with the correct address assignment) in the HOSTS file on the workstation or in a DNS server.
IsolationLevel (IL)	IsolationLevel={ALL | CHANGE | CURSOR_STABILITY | NO_COMMIT| REPEATABLE_READ}. Specifies the manner in which locks are acquired and released by the system. The possible value are: No Commit—Allows your program to read modified records even if they have not been committed by another person. Cursor Stability—Allows other processes to change a row that your application read, but does not change as long as your cursor is not on that row. Prevents other processes from changing records that your application has changed until your program commits them or terminates. Prevents your program from reading a modified record that has not been committed by another process.

***Table 3-1. DB2 Connection String Attributes** (cont.)*

Attribute	Description
IsolationLevel (IL) *(cont.)*	Repeatable Read—Prevents other processes from changing records that are read or changed by your application (including phantom records) until your program commits them or terminates. Prevents the application from reading modified records that have not been committed by another process. If your program opens the same query during a single unit of work under this isolation level, the results table will be identical to the previous table; however, it can contain updates made by your program.
Location (LOC)	Specifies the DB2 location name. Use the name defined during the local DB2 installation.
LogonID (UID)	The default logon ID used to connect to your DB2 database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID. For DB2 on UNIX, normal UNIX security is used. The LogonID value is your UNIX user ID.
MaximumClients (MC)	Specifies the maximum number of concurrent client sessions that the DB2 driver can carry. If the driver is used with an application server, select a value that will accommodate the number of users who will simultaneously access the host system through the DB2 driver. In a client configuration, use a small value to reduce the DB2 driver's memory requirements (unused client sessions needlessly consume memory on your machine).
OEMANSI (OA)	OEMANSI={0 | 1}. OEMANSI=1 translates data from the IBM PC character set to the ANSI character set.
Package (PCK)	Specifies the name of the package that the driver uses to process static and dynamic SQL for applications that use this data source definition. The default name is DEFxx where xx is the version number.

Table 3-1. DB2 Connection String Attributes (cont.)

Attribute	Description
PackageOwner (PO)	Specifies the AuthID assigned to the package. This DB2 AuthID must have authority to execute all the SQL in the package.
Password (PWD)	The password used to connect to your DB2 database.
Protocol (PROT)	Protocol={NETBIOS | TCP/IP}. Specifies the network protocol that the driver uses to communicate with the DB2 server. Select the protocol that this workstation will use (the workstation must have the hardware and software to support the selected protocol). NETBIOS and TCP/IP are supported by the driver. If you select TCP/IP, complete the IpAddress and TcpPort attributes.
QueryBlockSize (QBS)	The number of rows the driver retrieves when fetching from the server. This is not the number of rows given to the user. The default is 8 rows.
ResourceRelease (RR)	ResourceRelease={DEALLOCATION | COMMIT}. Specifies the release of database resources. Two options are available: Commit—Releases database resources after a commit and provides a high level of concurrency. Deallocation—Releases database resources when the connection is terminated.
StringDelimiter (SD)	StringDelimiter={SINGLE_QUOTE|DOUBLE_QUOTE}. Specifies the type of quotation marks (single or double) used to represent constant string values that are referenced by the SQL in the DBRM. This option should match the option used to delimit the literal strings referenced by your embedded SQL.
TcpPort (PORT)	The port number that is assigned to the DB2 server on the machine where the catalog tables are stored. Enter this port's numeric address or its name (8898 is the default port address). If you enter a port name, the driver must find this name (with the correct port assignment) in the SERVICES file on the workstation.

Table 3-1. DB2 Connection String Attributes *(cont.)*

Attribute	Description
Trace (TR)	Trace={0 | 1}. When Trace=1, generates a trace file in the driver directory that contains error information. The file is generated only if an error actually occurs.
UserBufferSize (UBS)	Specifies the size (in kilobytes) of the bulk packet that the DB2 driver uses to download data from the host. Permitted values are 1 to 63. For most environments, the default value is sufficient; however, adjusting the value can optimize some client applications as follows: For client applications that frequently download large amounts of data, a large buffer size can improve response time. For client applications that perform brief online transactions, a small buffer will maximize memory on the machine where the DB2 driver is installed.
WithHold (WH)	WithHold={0 | 1}. Specifies the cursor behavior of the application package used with this data source definition. This setting affects the operation of both the Static Bind Administrator and the Connect ODBC for DB2 driver. Enable this option only if you have enabled static binding for this data source definition. When WithHold=1, the Static Bind Administrator automatically adds the WITH HOLD clause to queries that it puts in the application's database resource module (DBRM). The WITH HOLD clause prevents DB2 from automatically closing the cursor when the application executes a COMMIT statement. If you use this data source definition with an application package that was created using With Hold Cursors, you must also set the With Hold Cursors option. When WithHold is set, SQLGetInfo( ) returns SQL_CB_PRESERVE for SQL_COMMIT_CURSOR_BEHAVIOR. For information about this function, refer to the Microsoft ODBC API.

Data Types

Table 3-2 shows how the DB2 data types map to the standard ODBC data types.

Table 3-2. DB2 Data Types

DB2	ODBC
Char	SQL_CHAR
Char() for Bit Data	SQL_BINARY
Date	SQL_TYPE_DATE
Decimal	SQL_DECIMAL
Float	SQL_DOUBLE
Integer	SQL_INTEGER
Long Varchar	SQL_LONGVARCHAR
Long Varchar for Bit Data	SQL_LONGVARBINARY
Smallint	SQL_SMALLINT
Time	SQL_TYPE_TIME
Timestamp	SQL_TYPE_TIMESTAMP
Varchar	SQL_VARCHAR
Varchar() for Bit Data	SQL_VARBINARY

Note: The Graphic, Vargraphic, and Long Vargraphic data types are not supported.

Isolation and Lock Levels Supported

DB2 supports isolation levels 0 (read uncommitted), 1 (read committed), and 2 (repeatable read). It supports record-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the DB2 driver. In addition, the following X/Open functions are supported:

- SQLProcedures
- SQLProcedureColumns

The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The DB2 database system supports a multiple connections and multiple statements per connection.

4 Connect ODBC for dBASE

Connect ODBC for dBASE (the "dBASE driver") supports the following files in the Windows and UNIX environments:

File Type	Operating Environments
dBASE III	Windows
dBASE IV and V	Windows and UNIX
Clipper	Windows
FoxPro 2.5 and 2.6	Windows
FoxPro 3.0	Windows and UNIX
FoxPro 3.0 database container (DBC)	Windows

Under Windows, Foxpro 6.0 is supported when using FoxPro 3.0 functionality. New FoxPro 6.0 functionality is not supported.

See the README file shipped with your DataDirect product for the file name of the dBASE driver.

System Requirements

The dBASE driver runs the SQL statements directly on dBASE- and FoxPro-compatible files. You do not need to own dBASE or FoxPro products to access these files.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 4-1. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

Note: To configure a data source for a FoxPro 3.0 database container (DBC), see "FoxPro 3.0 DBC" on page 94.

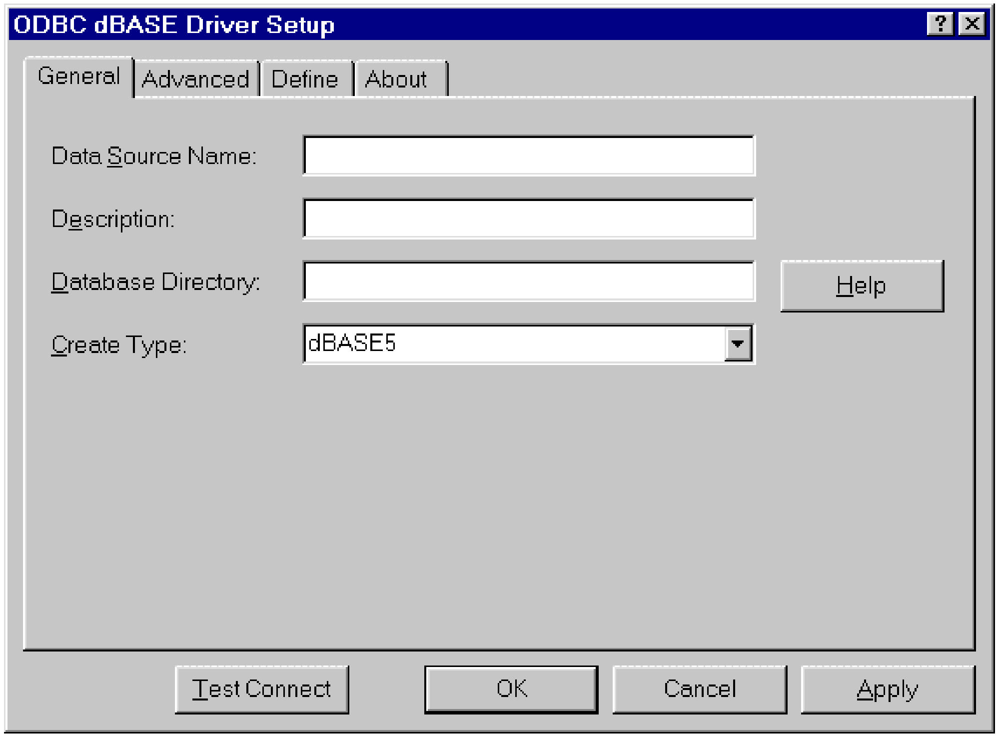
dBASE

To configure a dBASE data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC dBASE Driver Setup dialog box.

  If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the dBASE driver and click **Finish** to display the ODBC dBASE Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

4 Specify values for the following; then, click **Apply**.

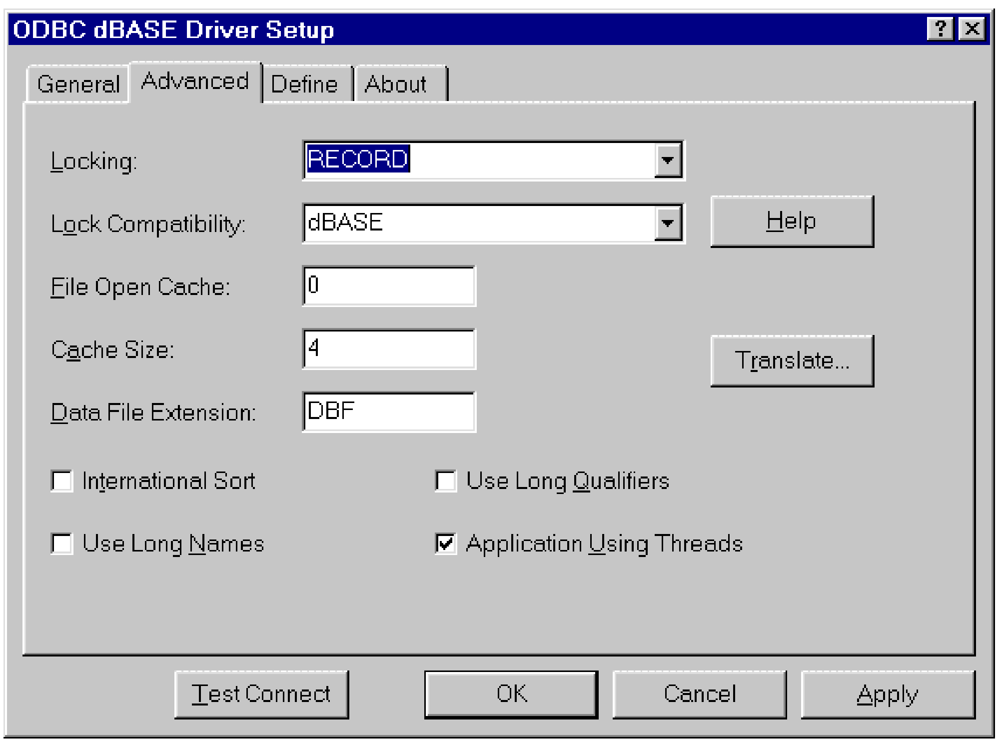
Data Source Name: A string that identifies this dBASE data source configuration in the system information. Examples include "Accounting" or "dBASE Files."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "dBASE files in C:\ACCOUNTS."

Database Directory: A path specification to the directory that contains the database files. If none is specified, the current working directory is used.

Create Type: The type of table or index to be created on a Create Table or Create Index statement. Select dBASE III, dBASE IV, dBASE V, Clipper, FoxPro1, FoxPro25, or FoxPro30. The default is dBASE V.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Locking: The level of locking for the database file (File, Record, or None). File locks all of the records in the table. Record (the default) locks only the records affected by the statement. None offers the best performance but is intended only for single-user environments.

Lock Compatibility: The locking scheme the driver uses when locking records. Select Clipper, dBASE, Fox, Q+E, or Q+EVirtual. The default is dBASE. The advantage of using a Q+E locking scheme over dBASE locking is that, on Inserts and Updates, Q+E locks only individual index tags, while dBASE locks the entire index. These values determine locking support as follows:

- Clipper specifies Clipper-compatible locking.
- dBASE specifies Borland-compatible locking.
- Fox specifies FoxPro- and FoxBASE-compatible locking.
- Q+E specifies that locks be placed on the actual bytes occupied by the record. Only applications that use the dBASE driver can read and write to the database. Other applications are locked out of the table completely (they cannot even read other records). This locking is compatible with earlier versions of Q+E products.
- Q+EVirtual specifies that locks be placed on bytes beyond the physical end-of-file. Q+EVirtual is the same as Q+E except that other applications can open the table and read the data.

If you are accessing a table with an application that uses the dBASE driver, your locking scheme does not have to match the Create Type. If you are accessing a table with two applications, however, and only one uses the dBASE driver, set your locking scheme to match the other application. For example, you do not have to set this value to Fox to work with a FoxPro table. But if you are using a FoxPro application simultaneously with an application using the dBASE driver on the same set of tables, set this value to Fox to ensure that your data does not become corrupted.

File Open Cache: An integer value to specify the maximum number of used file handles to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The disadvantage is that a user who specifies file locking on open may get a locking conflict even though no one appears to have the file open. The default is 0, which means no file open caching.

Cache Size: The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The default is 4.

Data File Extension: A setting to specify the file extension to use for data files. The default setting is DBF. The setting cannot be greater than three characters, and it cannot be one the driver already uses, such as MDX or CDX. The Data File Extension setting is used for all Create Table statements. Sending a Create Table using an extension other than the value specified for this option causes an error.

In other SQL statements, such as Select or Insert, users can specify an extension other than the one specified for this attribute. The DataFileExtension value is used when no extension is specified.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Use Long Names: Select this check box to use long filenames as table names. The maximum table name length is specific to the environment in which you are running (for example, in Windows 9*x*, the maximum table name length is 128).

Use Long Qualifiers: Select this check box to use long path names as table qualifiers. When you select this check box, path names can be up to 255 characters. The default length for path names is 128 characters.

Applications Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread-safety standards.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 If you use index files that have different names than their corresponding data files and you have not defined this association, click the **Define** tab. See "Defining Index Attributes" on page 100 for step-by-step instructions.

8 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

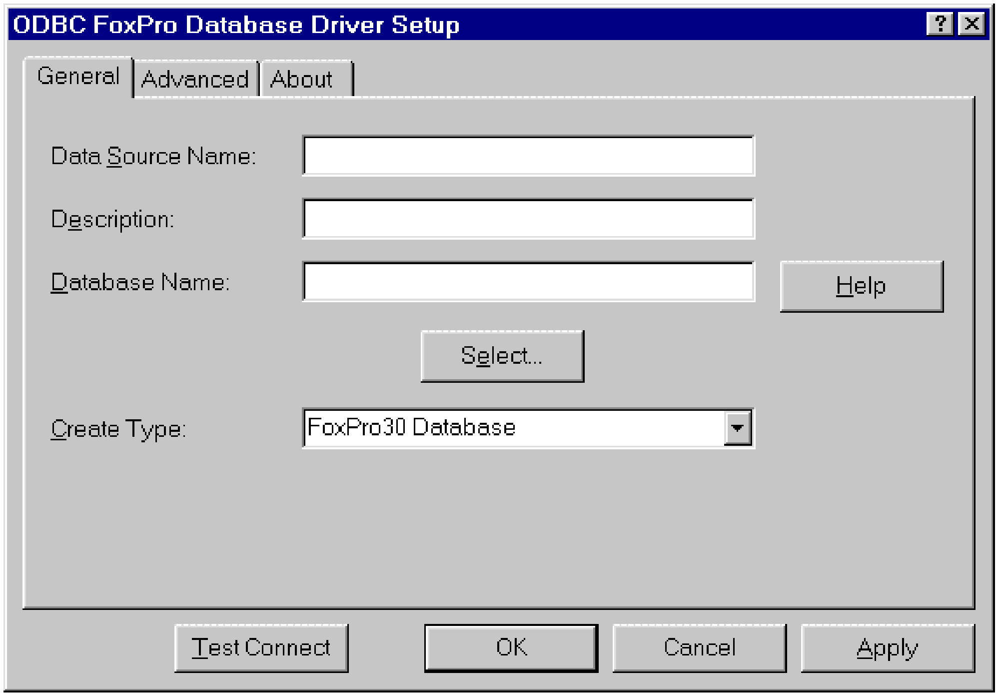
FoxPro 3.0 DBC

To configure a data source for FoxPro 3.0 database containers:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC FoxPro Driver Setup dialog box.

If you are configuring a new data source, click **Add**. A list of installed drivers appears. Select the dBASE driver and click **Finish** to display the ODBC FoxPro Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

4 Specify values for the following; then, click **Apply.**

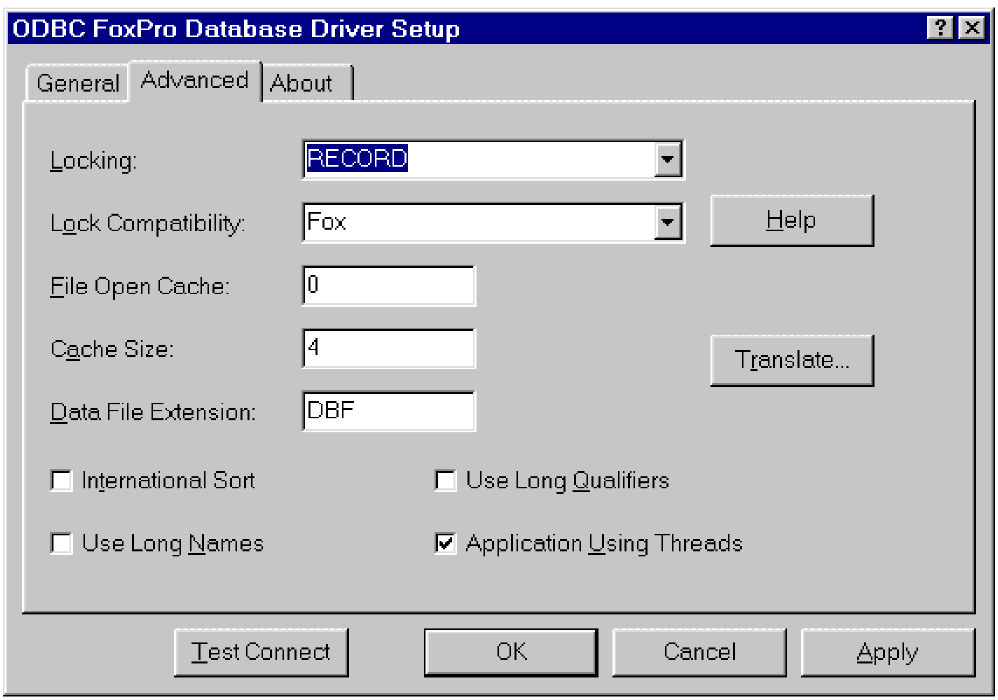
Data Source Name: A string that identifies this dBASE data source configuration in the system information, for example, "Accounting."

Description: An optional long description of a data source name, for example, "My Accounting Database."

Database Name: A path specification to the directory that contains the database files. If none is specified, the current working directory is used. Click **Select** to browse the available FoxPro 3.0 database containers.

Create Type: You cannot change the Create Type for the FoxPro 3.0 DBC driver.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Locking: The level of locking for the database file (File, Record, or None). File locks all of the records in the table. Record (the default) locks only the records affected by the statement. None offers the best performance but is intended only for single-user environments.

Lock Compatibility: The locking scheme the driver uses when locking records. Select Clipper, dBASE, Fox, Q+E, or Q+EVirtual. The default is dBASE. The advantage of using a Q+E locking scheme over dBASE locking is that, on Inserts and Updates, Q+E locks only individual index tags, while dBASE locks the entire index. These values determine locking support as follows:

- Clipper specifies Clipper-compatible locking.
- dBASE specifies Borland-compatible locking.
- Fox specifies FoxPro- and FoxBASE-compatible locking.
- Q+E specifies that locks be placed on the actual bytes occupied by the record. Only applications that use the dBASE driver can read and write to the database. Other applications are locked out of the table completely (they cannot even read other records). This locking is compatible with earlier versions of Q+E products.
- Q+EVirtual specifies that locks be placed on bytes beyond the physical end-of-file. Q+EVirtual is the same as Q+E except that other applications can open the table and read the data.

If you are accessing a table with an application that uses the dBASE driver, your locking scheme does not have to match the Create Type. If you are accessing a table with two applications, however, and only one uses the dBASE driver, set your locking scheme to match the other application. For example, you do not have to set this value to Fox to work with a FoxPro table. But if you are using a FoxPro application simultaneously with an application using the dBASE driver on the same set of tables, set this value to Fox to ensure that your data does not get corrupted.

File Open Cache: An integer value to specify the maximum number of used file handles to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The disadvantage is that a user who specifies file locking on open may get a locking conflict even though no one appears to have the file open. The default is 0, which means no file open caching.

Cache Size: The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The default is 4.

Data File Extension: A setting to specify the file extension to use for data files. The default setting is DBF. The setting cannot be greater than three characters, and it cannot be one the driver already uses, such as MDX or CDX. The Data File Extension setting is used for all Create Table statements. Sending a Create Table using an extension other than the value specified for this option causes an error.

In other SQL statements, such as Select or Insert, users can specify an extension other than the one specified for this attribute. The DataFileExtension value is used when no extension is specified.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Use Long Names: Select this check box to use long filenames as table names. The maximum table name length is specific to the environment in which you are running (for example, in Windows 9*x*, the maximum table name length is 128).

Use Long Qualifiers: Select this check box to use long path names as table qualifiers. When you select this check box, path names can be up to 255 characters. The default length for path names is 128 characters.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Defining Index Attributes

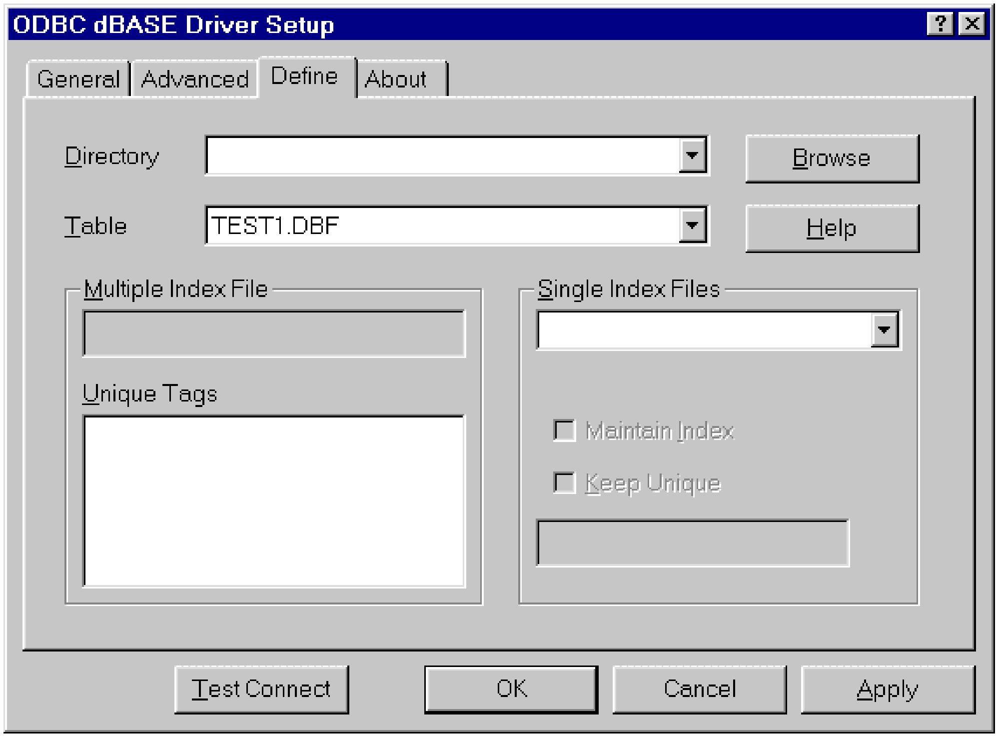
Note: This section does not apply to UNIX platforms. See "Defining Index Attributes on UNIX Platforms" on page 102 for information on how to set index attributes on the UNIX platforms.

The Define tab of the ODBC dBASE Driver Setup dialog box allows you to define the attributes of index files. With the exception of Clipper and dBASE III, the family of databases that includes dBASE and FoxPro uses a multiple index file associated with a particular table (database file). This index file has a .MDX or .CDX extension and is automatically maintained by the driver. Tags within this index can be marked as unique.

Clipper and dBASE III use single index files that are not automatically associated with a particular table. You can choose to have the driver maintain an index and choose whether or not the index is unique.

To define index file attributes, follow these steps:

1. Display the ODBC dBASE Driver Setup dialog box.
2. Click the **Define** tab.
3. Select a directory and table (database file). To display a directory listing, click **Browse.**



The upper section of the Define tab displays the directory name and the table containing the database information. The lower section of the tab displays the index information for that table.

4 Specify values for the following; then, click **Apply**.

Save ChangesMultiple Index File: Any multiple index file (with a .CDX extension or .MDX extension) associated with the table will be displayed in this field. This index file cannot be marked as unique, but tags within it can be.

Unique Tags: Tags associated with the multiple index file will appear in the list. To mark a tag as unique, single-click it; it will remain selected until you single-click it again. You can mark multiple tags in this manner.

Note: The Single Index Files pane is active only if you have selected a dBASE III or Clipper table.

Single Index Files: To define the attributes of a single index file, select the file from the drop-down file list.

Maintain Index: select this check box to associate the specified single index file with the selected table.

Keep Unique: select this check box to specify that the single index file is unique.

5 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Defining Index Attributes on UNIX Platforms

UNIX

Index files for dBASE contain index tags for each index that exists for a database file. These index tags can be marked as unique, that is, the driver will ensure that no duplicate values exist for the columns that define the index tag. The unique attribute is not natively supported by the dBASE or FoxPro products. The enforcement and recognition of the unique attribute is an extension of the MERANT dBASE driver. The driver must be notified that index tags are unique. No configuration is needed for unique indexes that were created using the MERANT dBASE driver. When using files that were not created with the MERANT dBASE driver, you must define unique index tags as outlined in the following procedure.

In the directory where the database and index files are located, use any plain text editor, such as vi, to define or edit the QEDBF.INI as follows:

1 Create a [`filename`] section where `filename` is the name of the database file. This entry is case sensitive and the file extension should be included.

2 In the [`filename`] section, specify the number of unique indexes on the file (`NUMUNIQUE=`) and the index specifications (`UNIQUE#=index_filename,index_tag`). The `index_tag` can be determined by calling the ODBC function SQLStatistics and examining the INDEX_NAME result column.

For example, to define two unique indexes on the accts.dbf table, the QEDBF.INI would be defined as:

```
[accts.dbf]
NUMUNIQUE=2
UNIQUE0=accts.mdx,ACCT_NAME
UNIQUE1=accts.mdx,ACCT_ID
```

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for dBASE is:

```
DSN=DBASE FILES;LCK=NONE;IS=0
```

Table 4-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 4-1. dBASE Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.

***Table 4-1. dBASE Connection String Attributes** (cont.)*

Attribute	Description
CacheSize (CSZ)	The number of 64KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The initial default is 4.
CreateType (CT)	CreateType={dBASE3 | dBASE4 | dBASE5 | Clipper | FoxPro25 | FoxPro30}. The type of table or index to be created on a Create Table or Create Index statement. The initial default is dBASE5.
Database (DB)	The directory in which the dBASE files are stored.
DataFileExtension (DFE)	String of three or fewer characters that specifies the file extension to use for data files. The initial default value is DBF. This value cannot be an extension the driver already uses, such as MDX or CDX. This value is used for all Create Table statements. Sending a Create Table using an extension other than the value specified for this attribute causes an error. In other SQL statements, such as Select or Insert, users can specify an extension other than the one specified for this attribute. The DataFileExtension value is used when no extension is specified.
DataSourceName (DSN)	A string that identifies a dBASE data source configuration in the system information. Examples include "Accounting" or "dBASE Files."
ExtensionCase (EC) UNIX	ExtensionCase={LOWER | UPPER}. This attribute specifies whether upper- or lowercase file extensions are accepted. If ExtensionCase=Lower, lowercase extensions are accepted. If ExtensionCase=Upper (the default), uppercase extensions are accepted.

Table 4-1. dBASE Connection String Attributes (cont.)

Attribute	Description
FileOpenCache (FOC)	The maximum number of used file handles to cache. For example, when FileOpenCache=4, and a user opens and closes four files, the files are not actually closed. The driver keeps them open so that if another query uses one of these files, the driver does not have to perform another open, which is expensive. The advantage of using file open caching is increased performance. The disadvantage is that a user who tries to open the file exclusively may get a locking conflict even though no one appears to have the file open. The initial default is 0.
IntlSort (IS)	IntlSort={0 | 1}. This attribute determines the order that records are retrieved when you issue a Select statement with an Order By clause. If IntlSort=0 (the initial default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If IntlSort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Table 4-1. dBASE Connection String Attributes (cont.)

Attribute	Description
LockCompatibility (LCOMP)	LockCompatibility={Clipper | dBASE | Fox | Q+E | Q+EVirtual}. The locking scheme to be used in your dBASE tables. The default is dBASE. The advantage of using a Q+E locking scheme over dBASE locking is that, on Inserts and Updates, Q+E locks only individual index tags, while dBASE locks the entire index. ■ LockCompatibility=Clipper specifies Clipper-compatible locking. ■ LockCompatibility=dBASE specifies Borland-compatible locking. This is the initial default for all platforms. ■ LockCompatibility=Fox specifies FoxPro-compatible locking. ■ LockCompatibility=Q+E specifies that locks be placed on the actual bytes occupied by the record. Only applications that use the dBASE driver can read and write to the database. Other applications are locked out of the table completely (they cannot even read other records). This locking is compatible with earlier versions of Q+E products. ■ LockCompatibility=Q+EVirtual specifies that locks be placed on bytes beyond the physical end-of-file. Q+EVirtual is the same as Q+E except that other applications can open the table and read the data.

***Table 4-1. dBASE Connection String Attributes** (cont.)*

Attribute	Description
LockCompatibility (LCOMP) *(cont.)*	If you are accessing a table with an application that uses the dBASE driver, your locking scheme does not have to match the Create Type. If you are accessing a table with two applications, however, and only one uses the dBASE driver, set your locking scheme to match the other application. For example, you don't have to set LCOMP=Fox to work with a FoxPro table. But if you are using a FoxPro application simultaneously with an application using the dBASE driver on the same set of tables, set LCOMP=Fox to ensure that your data does not get corrupted.
Locking (LCK)	Locking={NONE | RECORD | FILE}. This attribute determines the level of locking for the database tables. Locking=NONE offers the best performance but is intended only for single-user environments. Locking=RECORD locks only the records affected by the statement. This is the initial default for all platforms. Locking=FILE locks all of the records in the table.
ModifySQL (MS)	ModifySQL={0 | 1}. This attribute is provided for backward compatibility with earlier versions of MERANT products. It determines whether the driver modifies SQL statements to conform to ODBC specifications or passes the SQL statement directly to dBASE. Specify ModifySQL=1 to have the driver modify the SQL statement to conform to ODBC specifications. Specify ModifySQL=0 to have the driver understand SQL dialects found in earlier drivers. The default is 1.

Table 4-1. dBASE Connection String Attributes (cont.)

Attribute	Description
UltraSafeCommit (USF)	UltraSafeCommit={0 | 1}. This attribute specifies when the driver flushes the file cache. If UltraSafeCommit=1, the driver updates directory entries after each Commit. This decreases performance. If UltraSafeCommit=0 (the default), the driver updates the directory entry when the file is closed. In this case, a machine "crash" before closing the file causes newly inserted records to be lost.
UseLongNames (ULN)	UseLongNames={0 | 1}. This attribute specifies whether the driver uses long filenames as table names. The default is 0, do not use long filenames. If UseLongNames=1, the driver uses long filenames. The maximum table name length is specific to the environment in which you are running (for example, in Windows 9*x*, the maximum table name length is 128).
UseLongQualifiers (ULQ)	UseLongQualifiers={0 | 1}. This attribute specifies whether the driver uses long path names as table qualifiers. The default is 0, do not use long path names (the default length of path names is 128 characters). If UseLongQualifiers=1, the driver uses long path names (up to 255 characters).

Data Types

Table 4-2 shows how dBASE data types map to the standard ODBC data types. These dBASE data types can be used in a Create Table statement. See Appendix A, "SQL for Flat-File Drivers," on page 377 for the syntax of the Create Table statement.

Table 4-3 shows how the additional FoxPro 3.0 tables and database containers map to the ODBC data types.

Note: A few products can create dBASE files with numbers that do not conform to the precision and scale of the Number column. For example, these products can store 100000 in a column declared as NUMBER(5,2). When this occurs, the dBASE driver displays error 1244, "Unsupported decimal format." To remedy this situation, multiply the nonconforming column by 1, which converts it to the Float data type. For example:

```
SELECT BADCOL * 1 FROM BADFILE
```

BADCOL * 1 is evaluated as an expression and is returned as a float value.

Table 4-2. dBASE Data Types

dBASE	ODBC
Binary[1]	SQL_LONGVARBINARY
Char[2]	SQL_CHAR
Date	SQL_TYPE_DATE
Float[3]	SQL_DECIMAL
General[4]	SQL_LONGVARBINARY
Logical	SQL_BIT
Memo	SQL_LONGVARCHAR
Numeric	SQL_DECIMAL

[1] dBASE V only

[2] 254 characters maximum (1024 for Clipper)

[3] dBASE IV and V only

[4] FoxPro and dBASE V only

Table 4-3. Additional FoxPro 3.0 Data Types

FoxPro 3.0	ODBC
Character (binary)	SQL_CHAR
Currency	SQL_DOUBLE
Datetime	SQL_TYPE_TIMESTAMP
Double	SQL_DOUBLE
Integer	SQL_INTEGER
Memo (binary)	SQL_LONGVARBINARY

Column Names

Column names in SQL statements (such as Select and Insert, for example) can be up to ten characters long. A column name can contain alphanumeric characters and the hyphen character (-). The first character must be a letter (a through z).

Select Statement

You use a SQL Select statement to specify the columns and records to be read. All of the Select statement clauses described in Appendix A, "SQL for Flat-File Drivers," on page 377 are supported by dBASE Select statements. This section describes the information that is specific to dBASE, which is Rowid.

Rowid Pseudo-Column

Each dBASE record contains a special column named Rowid. This field contains a unique number that indicates the record's sequence in the database. For example, a table that contains 50 records has Rowid values from 1 to 50 (if no records are marked deleted). You can use Rowid in Where and Select clauses.

Rowid is particularly useful when you are updating records. You can retrieve the Rowid of the records in the database along with the other field values. For example:

```
SELECT last_name, first_name, salary, rowid FROM emp
```

Then you can use the Rowid of the record that you want to update to ensure that you are updating the correct record and no other. For example:

```
UPDATE emp set salary = 40000 FROM emp WHERE rowid=21
```

The fastest way of updating a single row is to use a Where clause with the Rowid. You cannot update the Rowid column.

Select statements that use the Rowid pseudo-column in the Where clause achieve maximum performance only for exact equality matches. If you use range scans instead of exact equality matches, a full table scan is performed. For example:

```
SELECT * FROM emp WHERE rowid=21    //fast search
SELECT * FROM emp WHERE rowid <=25  //full table scan
```

Alter Table Statement

The dBASE driver supports the Alter Table statement to add one or more columns to a table or to delete (drop) a single column.

The Alter Table statement has the form:

```
ALTER TABLE table_name {ADD column_name data_type |
ADD(column_name data_type [, column_name data_type]. . . ) |
DROP[COLUMN] column_name}
```

table_name is the name of the table to which you are adding or dropping columns.

column_name assigns a name to the column you are adding or specifies the column you are dropping.

data_type specifies the native data type of each column you add.

For example, to add two columns to the emp table:

```
ALTER TABLE emp (ADD startdate date, dept char (10))
```

You cannot add columns and drop columns in a single statement, and you can drop only one column at a time. For example, to drop a column:

```
ALTER TABLE emp DROP startdate
```

The Alter Table statement fails if you attempt to drop a column upon which other objects, such as indexes or views, are dependent.

Create Index Statement

The type of index you create is determined by the value of the CreateType attribute, which you set in the setup dialog box (for UNIX, edit the system information file) or as a connection string option. The index can be:

- dBASE III (.NDX)
- dBASE IV or V (.MDX)
- Clipper (.NTX)
- FoxPro (.CDX)

The syntax for creating an index is:

```
CREATE [UNIQUE] INDEX index_name ON base_table_name
(field_name [ASC | DESC] [,field_name [ASC | DESC]] ...)
```

index_name is the name of the index file. For FoxPro and dBASE IV or V, this is a tag, which is required to identify the indexes in an index file. Each index for a table must have a unique name.

Unique means that the driver creates an ANSI-style unique index over the column and ensures uniqueness of the keys. Use of unique indexes improves performance. ANSI-style unique indexes are different from dBASE-style unique indexes. With ANSI-style unique indexes, you receive an error message when you try to insert a duplicate value into an indexed field. With dBASE-style unique indexes, you do not see an error message when you insert a duplicate value into an indexed field. This is because only one key is inserted in the index file.

base_table_name is the name of the database file whose index is to be created. The .DBF extension is not required; the driver automatically adds it if it is not present. By default, dBASE IV or V index files are named *base_table_name.*MDX and FoxPro indexes are named *base_table_name.*CDX.

field_name is a name of a column in the dBASE table. You can substitute a valid dBASE-style index expression for the list of field names.

Asc tells dBASE to create the index in ascending order. Desc tells dBASE to create the index in descending order. By default, indexes are created in ascending order. You cannot specify both Asc and Desc orders within a single Create Index statement. For example, the following statement is invalid:

```
CREATE INDEX emp_i ON emp (last_name ASC, emp_id DESC)
```

Table 4-4 shows the attributes of the different index files supported by the dBASE driver. For each type supported, it provides the following details:

- Whether dBASE-style unique indexes are supported
- Whether descending order is supported
- The maximum size supported for key columns
- The maximum size supported for the column specification in the Create Index statement
- Whether production/structural indexes are supported

Table 4-4. dBASE-Compatible Index Summary

Create Type .Extension	dBASE UNIQUE	DESC	Max Size of Key Column	Max Size of Column Specification	Production/ Structural Indexes	Supports FOR Expressions
dBASE III .NDX	Yes	No	100	219	No	No
dBASE IV, V .MDX	Yes	Yes	100	220	Yes	Yes
Clipper .NTX	Yes	Yes	250	255	No	Yes

* Compact IDX indexes have the same internal structure as a tag in a CDX file. These indexes can be created if the IDX extension is included with the index name in the Create Index statement.

***Table 4-4. dBASE-Compatible Index Summary** (cont.)*

Create Type .Extension	dBASE UNIQUE	DESC	Max Size of Key Column	Max Size of Column Specification	Production/ Structural Indexes	Supports FOR Expressions
FoxPro .IDX*	Yes	Yes	240	255	No	Yes
FoxPro .CDX	Yes	Yes	240	255	Yes	Yes

* Compact IDX indexes have the same internal structure as a tag in a CDX file. These indexes can be created if the IDX extension is included with the index name in the Create Index statement.

Drop Index Statement

The syntax for dropping an index is as follows:

```
DROP INDEX table_name.index_name
```

table_name is the name of the dBASE file without the extension.

For FoxPro and dBASE IV or V, *index_name* is the tag. Otherwise, *index_name* is the name of the index file without the extension.

To drop the index EMPHIRE.NDX, issue the following statement:

```
DROP INDEX emp.emphire
```

Pack Statement

When records are deleted from a dBASE file, they are not removed from the file. Instead, they are marked as having been deleted. Also, when memo fields are updated, space may be wasted in the files. To remove the deleted records and free the unused space from updated memo fields, you must use the Pack statement. It has the following form:

```
PACK filename
```

filename is the name of the dBASE file to be packed. The .DBF extension is not required; the driver automatically adds the extension if it is not present. For example:

```
PACK emp
```

You cannot pack a file that is opened by another user, and you cannot use the Pack statement in manual commit mode.

For the specified file, the Pack statement does the following:

- Removes all deleted records from the file
- Removes the entries for all deleted records from .CDX and .MDX files having the same name as the file
- Compresses unused space in the memo (.DBT or .FPT) file

SQL Statements for FoxPro 3.0 Database Containers

The FoxPro DBC driver supports four additional SQL statements:

- Create Database
- Add Table
- Remove Table
- Use

To create a new FoxPro 3.0 database container, use

```
CREATE DATABASE database_name
```

To add an existing table to the database container, use

```
ADD TABLE table_name
```

To remove a table from the database container (not delete the table, but unlink it from the database container), use

```
REMOVE TABLE table_name
```

To set the current database container to an existing database container, use

```
USE database_name
```

To add or delete columns from a table in a database container, use the Alter Table statement (see "Alter Table Statement" on page 113).

Locking

With the dBASE driver, you can build and run applications that share dBASE database files on a network. Whenever more than one user is running an application that accesses a shared database file, the applications should lock the records that are being changed. Locking a record prevents other users from locking, updating, or deleting the record.

Levels of Database Locking

The dBASE driver supports three levels of database locking: NONE, RECORD, and FILE. You can set these levels in

- The connection string (LCK=)
- The setup dialog box

No locking offers the best performance but is intended only for single-user environments.

With record or file locking, the system locks the database tables during Insert, Update, Delete, or Select...For Update statements. The locks are released when the user commits the transaction. The locks prevent other users from modifying the locked objects, but they do not lock out readers.

With record locking, only records affected by the statement are locked. Record locking provides better concurrency with other users who also want to modify the table.

With file locking, all the records in the table are locked. File locking has lower overhead and may work better if records are modified infrequently, if records are modified primarily by one user, or if a large number of records are modified.

Using Locks on Local Files

If you use database locking and are accessing files locally (not on a network), run the DOS utility SHARE.EXE before running Windows 9*x*. If you add SHARE.EXE to your AUTOEXEC.BAT file, it runs automatically each time you boot your computer.

Limit on Number of Locks

There is a limit on the number of locks that can be placed on a file. If you are accessing a dBASE file from a server, the limit depends on the server (see your server documentation).

If you are accessing a dBASE file locally, the limit depends on the buffer space allocated when SHARE.EXE was loaded (see your DOS documentation). If you are exceeding the number of locks available, you may want to switch to file locking.

How Transactions Affect Record Locks

When an Update or Delete statement is run, the driver locks the records affected by that statement. The locks are released after the driver commits the changes. Under manual commit mode, the locks are held until the application commits the transaction. Under autocommit mode, the locks are held until the statement is run.

When a Select...For Update statement is run, the driver locks a record only when the record is fetched. If the record is updated, the driver holds the lock until the changes are committed. Otherwise, the lock is released when the next record is fetched.

Isolation and Lock Levels Supported

dBASE supports isolation level 1. It supports both file- and record-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the dBASE driver. In addition, the following function is supported: SQLSetPos.

The dBASE driver also supports backward and random fetching in SQLExtendedFetch and SQLFetchScroll. The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

dBASE supports multiple connections and multiple statements per connection.

5 Connect ODBC for Excel Workbook

Connect ODBC for Excel Workbook (the "Excel Workbook driver") is supported in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the Excel Workbook driver.

System Requirements

The Excel Workbook driver requires the OLE32.DLL. This DLL is typically provided by the Windows System. It is also provided with Excel version 5 or 7. The Excel Workbook driver does not require Excel 5 or 7 to read .XLS files. To modify the files, however, you must use the Excel application.

Using an Excel Database

An Excel workbook database is any Excel 5 or 7 or .XLS workbook file that contains one or more named lists containing record data. Each named list is treated as a table within the workbook database. The lists must be set up as follows:

- The first row in each list must contain the column labels that identify the fields in each record.

- The name of each list must be a book-level name, not a sheet-level name.
- Although the Excel Workbook driver recognizes one list named "Database" per .XLS file, it is recommended that you avoid using this name—both to ensure that the Excel Workbook driver recognizes other lists in the file and to prevent future naming conflicts.

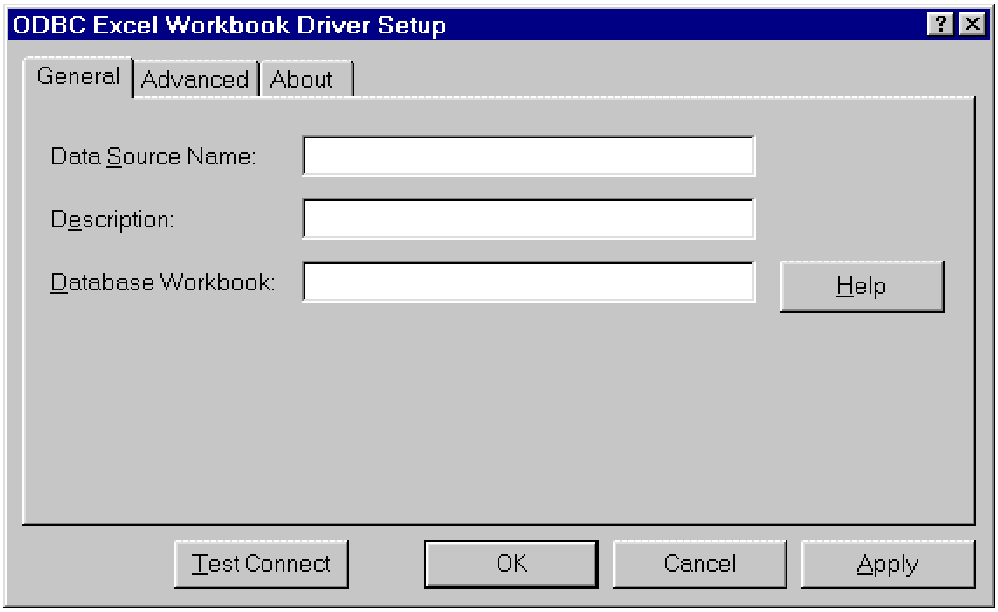
To name a table from within Excel, highlight all the columns that are part of the table. After the columns are highlighted, from the menu bar select **Insert,** then **Name,** then **Define.** Type the table name in the dialog box to describe the highlighted table.

Configuring Data Sources

Data sources are configured and modified through the ODBC Administrator. To configure an Excel data source:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Excel Workbook Driver Setup dialog box.

   If you are configuring a new data source, click **Add.** A list of installed drivers appears. Select the Excel Workbook driver and click **Finish** to display the ODBC Excel Workbook Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

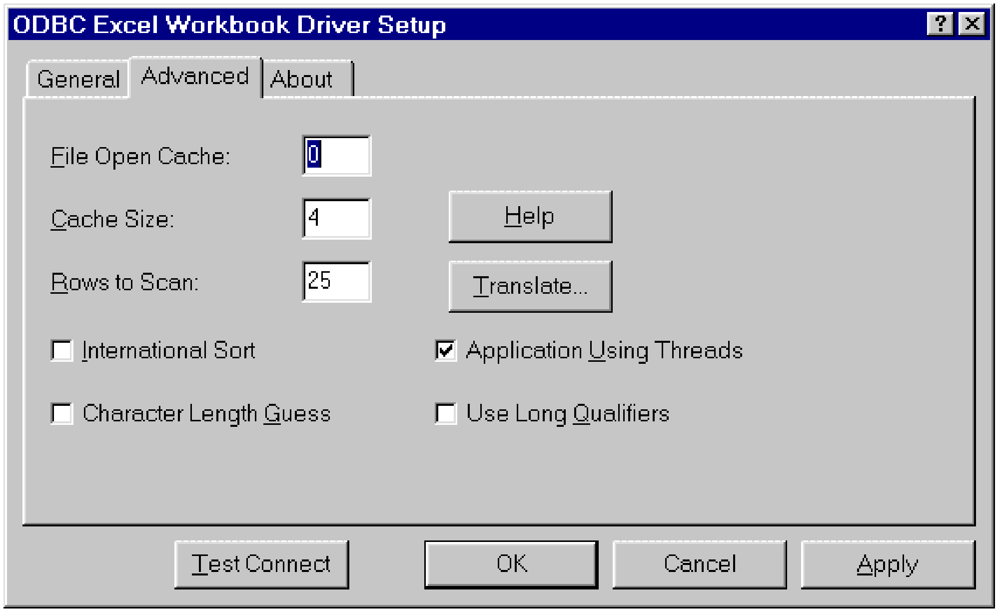
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Excel data source configuration in the system information. Examples include "Accounting" or "Excel Database."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "Excel .XLS file data."

Database Workbook: Identifies the workbook file containing the Excel database.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

File Open Cache: An integer value that specifies the maximum number of unused file opens to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The default is 0, which means no file open caching.

Cache Size: The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. The value must be a multiple of 64. The default is 256. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again.

Rows to Scan: An integer value that specifies the number of rows to scan to determine the column data types. The default is 25 rows. A value of 0 means to scan the whole table.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Character Length Guess: Determines whether the driver tries to guess the length of character columns. If the check box is cleared (the default), the driver does not try to guess the length of character columns; instead, it assumes that all character columns have a length of 255. If set to 1, the driver tries to guess the length.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Use Long Qualifiers: Set this check box to use long pathnames as table qualifiers. When you set this check box, pathnames can be up to 255 characters. The default length for pathnames is 128 characters.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel.** If you click **OK,** the values you have specified become the defaults when you connect to the data source. You can change these default values by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

DSN=*data_source_name*[;*attribute*=*value*[;*attribute*=*value*]...]

An example of a connection string for Excel is:

```
DSN=EXCEL FILES;FOC=4
```

Table 5-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 5-1. Excel Connection String Attributes

Attribute	Description
ApplicationUsing Threads	ApplicationUsingThreads={0 | 1}. Ensures that the drivers works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you can set this option to 0 to avoid additional processing required for ODBC thread safety standards.
CacheSize (CSZ)	The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The initial default is 4.
CharacterLength Guess (CLG)	CharacterLengthGuess={0 | 1}.This attribute determines whether the driver tries to guess the length of character columns. If set to 0 (the initial default), the driver does not try to guess the length of character columns; instead, it assumes that all character columns have a length of 255. If set to 1, the driver tries to guess the length.
Database (DB)	The name of the .XLS workbook file containing the Excel database.

Table 5-1. Excel Connection String Attributes (cont.)

Attribute	Description
DataSourceName (DSN)	A string that identifies an Excel data source configuration in the system information. Examples include "Accounting" or "Excel Files."
FieldGuessing (FG)	FieldGuessing={0 | 1}. This attribute determines whether the driver will try to guess column data types. If FieldGuessing=1 (the default), the driver attempts to guess the data types. If FieldGuessing=0, the driver assumes that all data types are SQL_CHAR.
FileOpenCache (FOC)	The maximum number of unused file opens to cache. For example, when FileOpenCache=4, and a user opens and closes four files, the files are not actually closed. The driver keeps them open so that if another query uses one of these files, the driver does not have to perform another open, which is expensive. The advantage of using file open caching is increased performance. The initial default is 0.
IntlSort (IS)	IntlSort={0 | 1}. This attribute determines the order that records are retrieved when you issue a Select statement with an Order By clause. If IntlSort=0 (the initial default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If IntlSort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Table 5-1. Excel Connection String Attributes (cont.)

Attribute	Description
ModifySQL (MS)	ModifySQL={0 | 1}. This attribute is provided for backward compatibility with earlier versions of Q+E products. It determines whether the driver modifies SQL statements to conform to ODBC specifications or passes the SQL statement directly to Excel. Specify ModifySQL=1 to have the driver modify the SQL statement to conform to ODBC specifications. Specify ModifySQL=0 to have the driver understand SQL dialects found in earlier drivers. The default is 1.
ScanRows (SR)	The number of rows to scan to determine the column data types. A value of 0 means to scan the whole table. The initial default is 25.
UseLongQualifiers (ULQ)	UseLongQualifiers={0 | 1}. It specifies whether the driver uses long pathnames as table qualifiers. The default is 0, do not use long pathnames (the default length of pathnames is 128 characters). If UseLongQualifiers=1, the driver uses long pathnames (up to 255 characters).

Data Types

Table 5-2 shows how Excel data types map to the standard ODBC data types.

Table 5-2. Excel Data Types

Excel	ODBC
Char	SQL_VARCHAR
Date	SQL_TYPE_DATE
Logical	SQL_BIT
Number Float	SQL_DOUBLE

Table 5-2. Excel Data Types (cont.)

Excel	ODBC
Time	SQL_TYPE_TIME
Timestamp	SQL_TYPE_TIMESTAMP

Table and Column Names

Table names are case-sensitive when using the Excel Workbook driver.

Excel files contain column names in the first row of the database section or named list that is used as a table. Use these names as the column names in a Select statement. Column names are limited to 32 characters. If column names are lowercase, contain upper- and lowercase, contain blank spaces, or are reserved words, surround them with the grave character (`) (ASCII 96).

For example:

```
SELECT `name` FROM emp
```

Select Statement

You use a SQL Select statement to specify the columns and records to be read. All of the Select statement clauses described in Appendix A, "SQL for Flat-File Drivers," on page 377 are supported by Excel Select statements.

Create Table Statement

The Excel Workbook driver does not support the Create Table statement.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Excel driver. In addition, the following function is supported: SQLSetPos.

The Excel Workbook driver supports backward and random fetching in SQLExtendedFetch or SQLFetchScroll. The drivers support the minimum SQL grammar.

Number of Connections and Statements Supported

The Excel Workbook driver supports multiple connections and multiple statements per connection.

6 Connect ODBC for Informix

Connect ODBC for Informix (the "Informix driver") supports multiple connections to the Informix database system versions 7.*x* and 9.*x* in the Windows 9*x*, Windows NT, and UNIX environments.

See the README file shipped with your DataDirect product for the file name of the Informix driver.

System Requirements

The following section lists requirements for all supported platforms.

Windows 9*x* and Windows NT

To access remote Informix 7.*x* or 9.*x* databases through the Informix driver, you need one of the following:

- INFORMIX-Connect for Windows platforms, version 2.*x*
- INFORMIX-Client Software Developer’s Kit for Windows platforms, version 2.*x*

Note: The DataDirect Informix driver does not work with versions earlier than 9.1.3 of the previous INFORMIX-Connect product.

Use the **Setnet32** utility supplied by Informix to define servers and the location of the INFORMIX directory. Use **Ilogin** to test your connection to the Informix server. The path to the ISQLT09A.DLL must be in your PATH environment variable.

Enabling MTS

The Informix driver can take advantage of Microsoft Transaction Server (MTS) capabilities, specifically, the Distributed Transaction Coordinator (DTC) using the XA Protocol. To enable the DTC support, the clients must be INFORMIX-Connect version 2.20 or higher. For a general discussion of MTS and DTC, refer to the help file of the "Microsoft Transaction Server SDK."

To enable support for the DTC, you must do the following:

1 Use the **Setnet32** utility supplied by Informix to define:

   - The INFORMIXDIR environment variable, which identifies the location of the client programs, library files, message files, header files, and other Informix software components
   - The INFORMIXSERVER environment variable, which identifies the default database server
   - An Informix server, which identifies either an existing Informix database server or a new one
   - A host name, which identifies the host computer with the database server you want to use
   - A user name, which identifies a user name for an account on the currently selected host computer
   - A password for the specified user name, if required

   When enlisting in a distributed transaction, the Informix clients only use the defaults specified in **Setnet32**.

2 Run the **regcopy** utility provided with INFORMIX-Connect to copy the registry entries created by **Setnet32** to an area in the registry that is accessible by the DTC. The DTC is a service, and

services do not search for configuration information in the Windows registry where **Setnet32** stores client products environment variables. Therefore, if you do not run regcopy after setting the defaults in **Setnet32**, enlistment in a distributed transaction will fail.

For information on using the **Setnet32** and **regcopy** utilities, see the Informix documentation.

UNIX (AIX, HP-UX, and Solaris for SPARC)

The environment variable INFORMIXDIR must be set to the directory where you have installed the Informix client.

For example, the following syntax is valid for C-shell users:

```
setenv INFORMIXDIR /databases/informix
```

For Bourne- or Korn-shell users, the following syntax is valid:

```
INFORMIXDIR=/databases/informix;export INFORMIXDIR
```

In addition, the INFORMIXSERVER variable must be set to the name of the Informix server (as defined in your $INFORMIXDIR/etc/sqlhosts file). For further details, refer to the Informix documentation.

For all UNIX platforms except HP-UX 10.10, you need INFORMIX-Client Software Developer's Kit for UNIX platforms, version 2.*x*, from Informix to access remote Informix 7.*x* or 9.*x* databases through the Informix driver. For HP-UX 10.10, you need the Informix client version 7.23.

Note: The DataDirect Informix driver for Solaris and HP-UX does not work with versions earlier than 9.1.3 of the previous products, INFORMIX-Connect and ESQL/C. The driver for AIX does not work with versions earlier than 9.1.4 of INFORMIX-Connect and ESQL/C.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

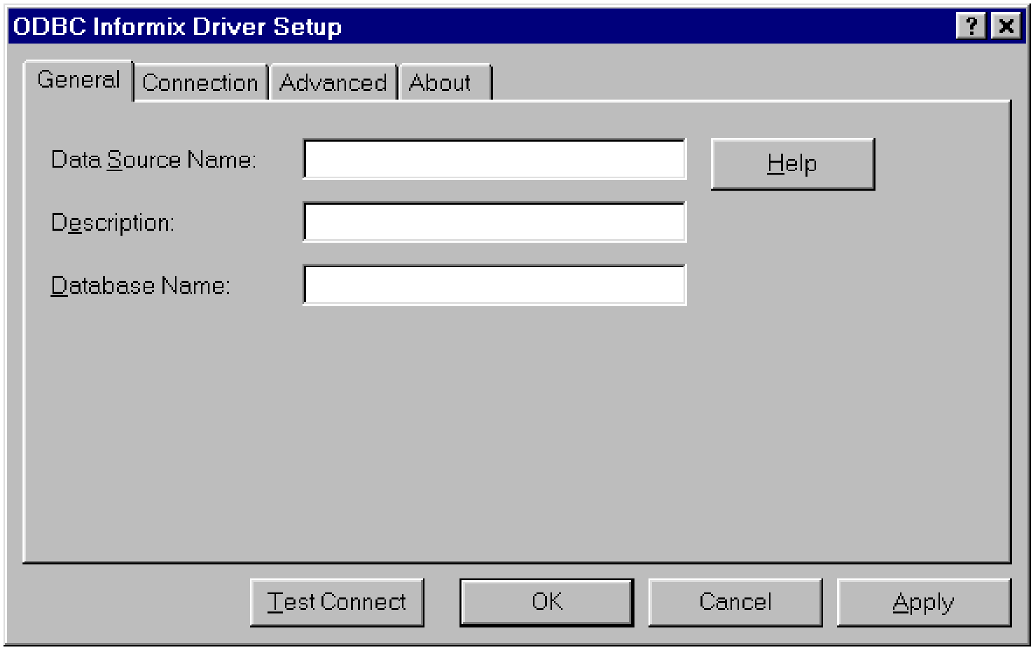
In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 6-1. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure an Informix data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Informix Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the appropriate Informix driver and click **Finish** to display the ODBC Informix Driver Setup dialog box.



3. At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 144 for details.

   - If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.

   - If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

     Verify that all required client software is properly installed. If it is not, you will see the message:

     ```
     Specified driver could not be loaded due to
     system error [xxx].
     ```

     Click **OK**.

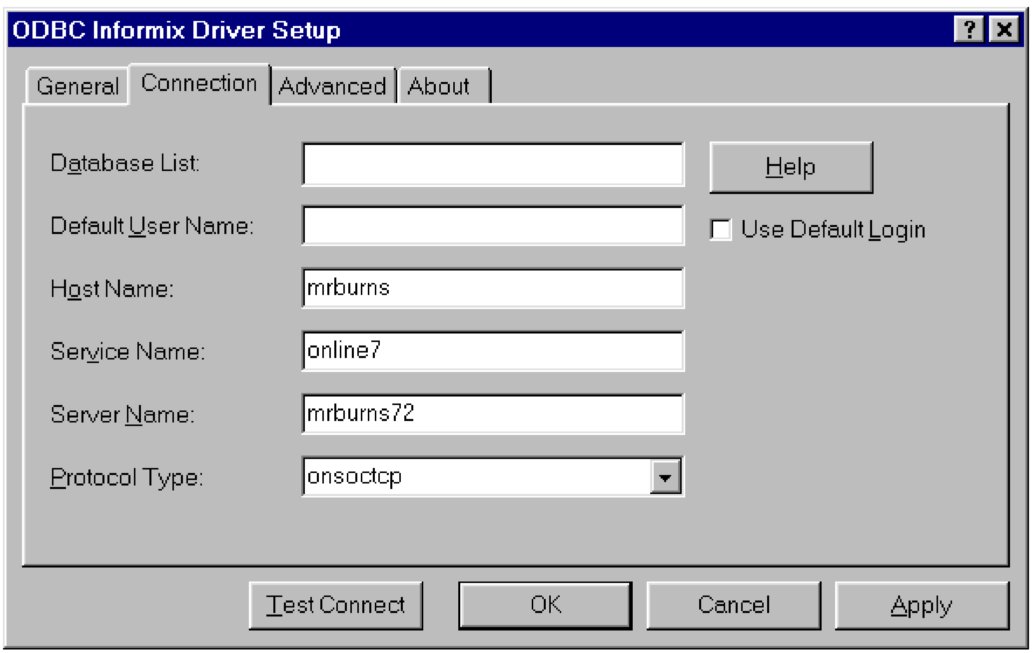
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Informix data source configuration in the system information. Examples include "Accounting" or "INFORMIX-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "Informix 7 files on Server number 1."

Database Name: The name of the database to which you want to connect by default.

5 Click the **Connection** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

Database List: The list of databases that will be displayed in the Logon dialog box if **Get DB List From Informix** on the Advanced tab is *not* checked. Separate multiple values with commas (for example, db1, db2, db3).

Default User Name: The name of the user as specified on the Informix server.

Use Default Login: Select this check box to read the Logon ID and Password entries directly from the Informix registry. The check box is cleared by default; that is, logon information is read from the system information, the connection string, or the Logon to Informix dialog box.

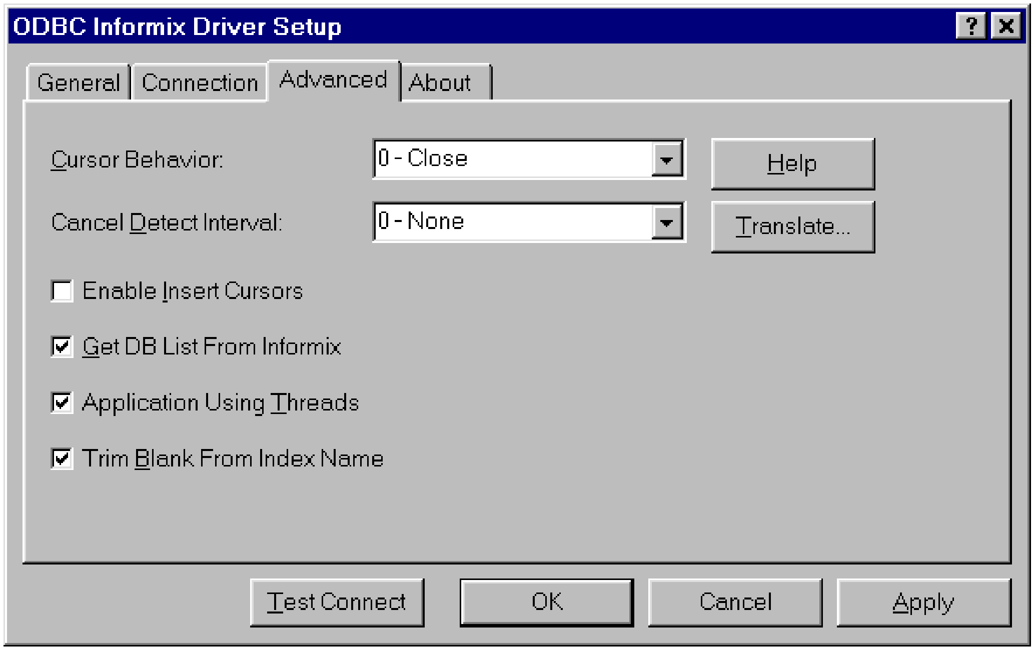
Host Name: The name of the machine on which the Informix server resides.

Service Name: The name of the service as it appears on the host machine. This service is assigned by the system administrator. The name you specify is displayed in the Informix Server Options dialog box.

Server Name: The name of the Informix server as it appears in the sqlhosts file.

Protocol Type: The protocol used to communicate with the server. Specify one or more values; separate the names with commas. Values can be olsocspx, olsoctcp, onsocspx, onsoctcp, seipcpip, sesocspx, and/or sesoctcp.

7 Click the **Advanced** tab to configure additional, optional settings for the data source.



8 Specify values for the following; then, click **Apply.**

Cursor Behavior: Holds cursor at the current position when the transaction ends if you select Preserve. Otherwise, leave this set to Close. Selecting Preserve may impact the performance of your database operations.

Cancel Detect Interval: Lets you cancel long-running queries in threaded applications. Select a value to determine how often the driver checks whether a request has been canceled using SQLCancel. For example, if CDI=5, then for every pending request, the driver checks every five seconds to see whether the user has canceled execution of the query using SQLCancel. The default is 0, which means that requests will not be canceled until the request has completed execution.

Enable Insert Cursors: Determines whether the driver can use Insert cursors during inserts governed by parameters. Using

Insert cursors improves performance during multiple Insert operations using the same statement. This option enables insert data to be buffered in memory before being written to disk. When this check box is cleared (the default), the driver does not use Insert cursors.

Get DB List From Informix: Determines whether the driver requests the database list to be returned from the Informix server or from the database list that the user entered during driver setup.

When the check box is checked (the default), the driver requests the database list from the Informix server. When cleared, the driver uses the list that was entered by the user at driver setup.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Clearing this check box avoids the additional processing required for ODBC thread-safety standards.

Trim Blank From Index Name: Specifies whether or not the leading space should be trimmed from a system-generated index name. This option is provided to address problems with applications that cannot process a leading space in index names. When this box is checked (the default), the driver trims the leading space.

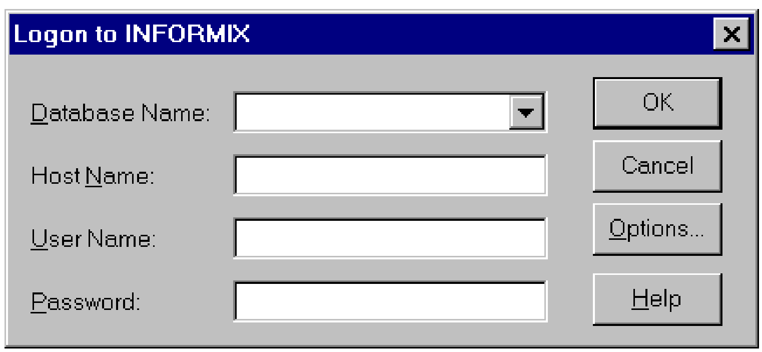
Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

9 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. The dialog box is as follows:



In this dialog box, do the following:

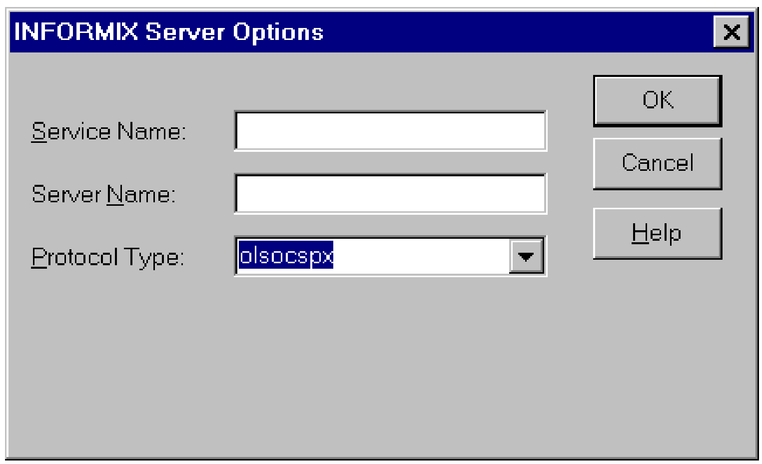
1 Type the name of the database you want to access or select the name from the Database Name drop-down list. The names on the list are determined by the status of the **Get DB List From Informix** check box on the Advanced tab. If the box is checked, the names displayed are returned from the Informix server. If cleared, the names displayed are returned from the user-entered list.

2 Type the name of the host machine on which the Informix server resides.

3 If required, type your user name as specified on the Informix server.

4 If required, type your password.

5 Optionally, click **Options** to display the Informix Server Options dialog box, where you can change the Service Name, Server Name, and Protocol Type that you specified in the ODBC Informix Driver Setup dialog box. Click **OK** to save your changes.



6 Click **OK** to complete the logon and to update these values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Informix is:

```
DSN=INFORMIX TABLES;DB=PAYROLL
```

Table 6-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 6-1. Informix Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.
CancelDetect Interval (CDI)	Lets you cancel long-running queries in threaded applications. Select a value to determine how often the driver checks whether a request has been canceled using SQLCancel. For example, if CDI=5, then for every pending request, the driver checks every five seconds to see whether the user has canceled execution of the query using SQLCancel. The default is 0, which means that requests will not be canceled until a request has completed execution.
CursorBehavior (CB)	CursorBehavior={0 | 1}. This attribute determines whether cursors will be preserved or closed at the end of each transaction. The default is 0 (close). Set this attribute to 1 if you want cursors to be held at the current position when the transaction ends. The value CursorBehavior=1 may impact the performance of your database operations.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies an Informix data source configuration in the system information. Examples include "Accounting" or "INFORMIX-Serv1."

Table 6-1. Informix Connection String Attributes (cont.)

Attribute	Description
EnableInsert Cursors (EIC)	EnableInsertCursors={0 | 1}. Determines whether the driver can use Insert cursors during inserts governed by parameters. The default value is 1 (driver uses Insert cursors). Using Insert cursors improves performance during multiple Insert operations using the same statement. This option enables insert data to be buffered in memory before being written to disk. When EnableInsertCursors=0, the driver does not use Insert cursors.
GetDBListFrom Informix (GDBLFI)	GetDBListFromInformix={0 | 1}. This attribute determines whether the driver requests the database list to be returned from the Informix server or from the database list that the user entered at driver setup. When set to 1, the default, the driver requests the database list from the Informix server. When set to 0, it uses the list that was entered by the user at driver setup.
HostName (HOST)	The name of the machine on which the Informix server resides.
LogonID (UID)	Your user name as specified on the Informix server.
Password (PWD)	A password.
Protocol (PRO)	Protocol={olsocspx | olsoctcp | onsocspx | onsoctcp | seipcpip | sesocspx | sesoctcp}. The protocol used to communicate with the server. You can specify one or more values; separate the names with commas.
ServerName (SRVR)	The name of the server running the Informix database.
Service (SERV)	The name of the service as it appears on the host machine. This service is assigned by the system administrator.

Table 6-1. Informix Connection String Attributes (cont.)

Attribute	Description
TrimBlankFrom IndexName (TBFIN)	TrimBlankFromIndexName={0 | 1}. Specifies whether or not the leading space should be trimmed from a system-generated index name. This option is provided to address problems with applications that cannot process a leading space in index names. When set to 1 (the default), the driver trims the leading space. When set to 0, the driver does not trim the space.
UseDefaultLogin (UDL)	UseDefaultLogin={0 | 1}. Specify 1 to read the Logon ID and Password directly from the Informix registry. The default is 0; that is, logon information is read from the system information, the connection string, or the Logon to Informix dialog box.

Data Types

Table 6-2 shows how the Informix data types map to the standard ODBC data types.

Table 6-2. Informix Data Types

Informix	ODBC
Blob	SQL_LONGVARBINARY
Boolean	SQL_BIT
Byte[1]	SQL_LONGVARBINARY
Char	SQL_CHAR
Clob	SQL_LONGVARCHAR
Date	SQL_TYPE_DATE
Datetime year to fraction(5)	SQL_TYPE_TIMESTAMP
Datetime year to fraction(f)[2]	SQL_TYPE_TIMESTAMP
Datetime year to second	SQL_TYPE_TIMESTAMP
Datetime year to day	SQL_TYPE_DATE
Datetime hour to second	SQL_TYPE_TIME
Datetime hour to fraction(f)[2]	SQL_TYPE_TIME
Decimal	SQL_DECIMAL
Float	SQL_DOUBLE
Int8	SQL_BIGINT
Integer	SQL_INTEGER
Interval year(p) to year	SQL_INTERVAL_YEAR
Interval year(p) to month	SQL_INTERVAL_YEAR_TO_MONTH
Interval month(p) to month	SQL_INTERVAL_MONTH
Interval day(p) to day	SQL_INTERVAL_DAY
Interval day(p) to hour	SQL_INTERVAL_DAY_TO_HOUR
Interval day(p) to minute	SQL_INTERVAL_DAY_TO_MINUTE
Interval day(p) to second	SQL_INTERVAL_DAY_TO_SECOND
Interval day(p) to fraction(f)[2]	SQL_INTERVAL_DAY_TO_SECOND
Interval hour(p) to hour	SQL_INTERVAL_HOUR
Interval hour(p) to minute	SQL_INTERVAL_HOUR_TO_MINUTE

[1]Not supported for Standard Engine Databases

[2]Fraction(f) types are mapped to fraction(5) in the driver. The precision is type dependent and the scale as 5.

Table 6-2. Informix Data Types *(cont.)*

Informix	ODBC
Interval hour(p) to second	SQL_INTERVAL_HOUR_TO_SECOND
Interval hour(p) to fraction(f)[2]	SQL_INTERVAL_HOUR_TO_SECOND
Interval minute(p) to minute	SQL_INTERVAL_MINUTE
Interval minute(p) to second	SQL_INTERVAL_MINUTE_TO_SECOND
Interval minute(p) to fraction(f)[2]	SQL_INTERVAL_MINUTE_TO_SECOND
Interval second(p) to second	SQL_INTERVAL_SECOND
Interval second(p) to fraction(f)[2]	SQL_INTERVAL_SECOND
Interval fraction to fraction(f)[2]	SQL_VARCHAR
Lvarchar	SQL_VARCHAR
Money	SQL_DECIMAL
Serial	SQL_INTEGER
Serial8	SQL_BIGINT
Smallfloat	SQL_REAL
Smallint	SQL_SMALLINT
Text[1]	SQL_LONGVARCHAR
Varchar[1]	SQL_VARCHAR

[1]Not supported for Standard Engine Databases

[2]Fraction(f) types are mapped to fraction(5) in the driver. The precision is type dependent and the scale as 5.

The Informix driver does not support any complex data types (for example, set, multiset, list, and named/unnamed abstract types). When the driver encounters a complex type it will return an Unknown Data Type error (SQL State HY000).

Isolation and Lock Levels Supported

If connected to an Online Server, Informix supports isolation levels 0 (read uncommitted), 1 (read committed), and 3 (serializable). The default is 1. The Standard Engine supports isolation level 0 (read uncommitted) only.

Informix also supports an alternative isolation level 1, called "cursor stability." Your ODBC application can use this isolation level by calling SQLSetConnectAttr (1040,1).

Additionally, if transaction logging has not been enabled for your database, then transactions are not supported by the driver (the driver is always in auto-commit mode).

Informix supports page-level and row-level locking.

See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Informix driver. In addition, the following functions are supported:

- SQLProcedures
- SQLColumnPrivileges
- SQLTablePrivileges
- SQLPrimaryKeys
- SQLForeignKeys
- SQLProcedureColumns

The driver also supports scrollable cursors with SQLFetchScroll or SQLExtendedFetch. The driver supports the core SQL grammar.

Number of Connections and Statements Supported

The Informix driver supports multiple connections and multiple statements per connection to the Informix database system.

7 Connect ODBC for OpenIngres

Connect ODBC for OpenIngres supports two separate drivers. Connect ODBC for OpenIngres (the "OpenIngres driver") supports OpenIngres 1.2 in the Windows 9*x*, Windows NT, HP-UX, AIX, and Solaris environments.

Connect ODBC for OpenIngres 2 (the "OpenIngres 2 driver") supports OpenIngres 1.2 and 2.0 databases in the Windows 9*x*, Windows NT, HP-UX, AIX, and Solaris environments.

See the README file shipped with your DataDirect product for the file names of the OpenIngres drivers.

System Requirements

The following section lists requirements for all supported platforms.

OpenIngres

To access OpenIngres databases from your client workstation you must have the OpenIngres/Net Release 1.2 product (int.wnt/03 or higher) installed on your client node.

OpenIngres 2

To access OpenIngres 2 databases from your client workstation you must have CA OpenIngres Net version 2.0 or higher installed on your client node.

OpenIngres and OpenIngres 2

For Windows platforms, you must have the environment variable II_SYSTEM set to the directory where you installed the OpenIngres/Net product. For example:

```
SET II_SYSTEM=C:\OPING
```

Two directories in II_SYSTEM, INGRES\BIN and INGRES\UTILITY, must be on your path.

For UNIX platforms, the remote or host OpenIngres databases must be INGRES 1.2 or later.

You must have the environment variable II_SYSTEM set to the directory above the directory where you installed the INGRES client.

For example, if you have installed your INGRES product in /databases/ingres, the following syntax is valid for C-shell users:

```
setenv II_SYSTEM /databases
```

For Bourne- or Korn-shell users, the following syntax is valid:

```
II_SYSTEM=/databases;export II_SYSTEM
```

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

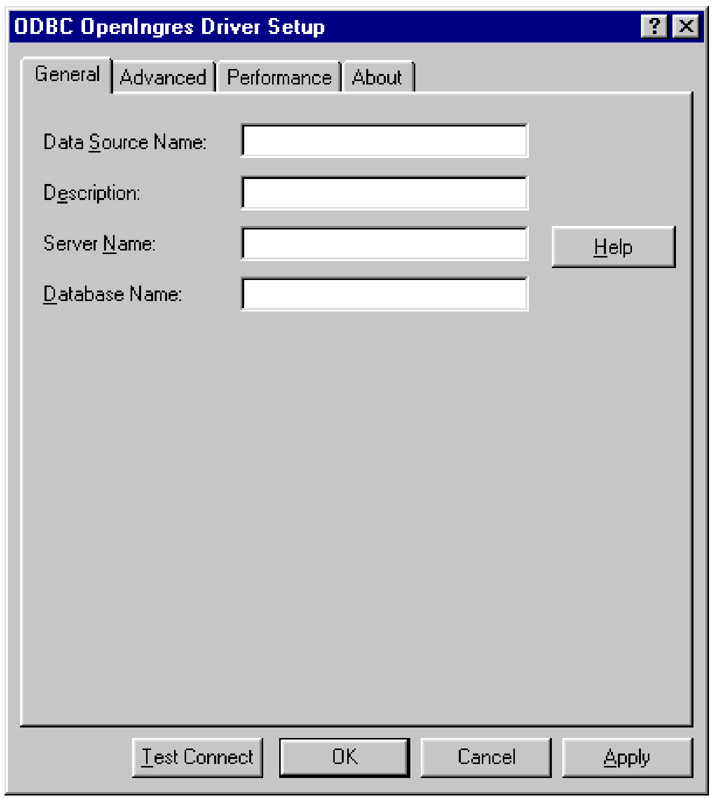
In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 7-1. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure an OpenIngres data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC OpenIngres Driver Setup dialog box.

  If you are configuring a new data source, click **Add** to display list of installed drivers. Select the OpenIngres driver of your choice and click **Finish** to display the ODBC OpenIngres Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting

to a Data Source Using a Logon Dialog Box" on page 164 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply.**

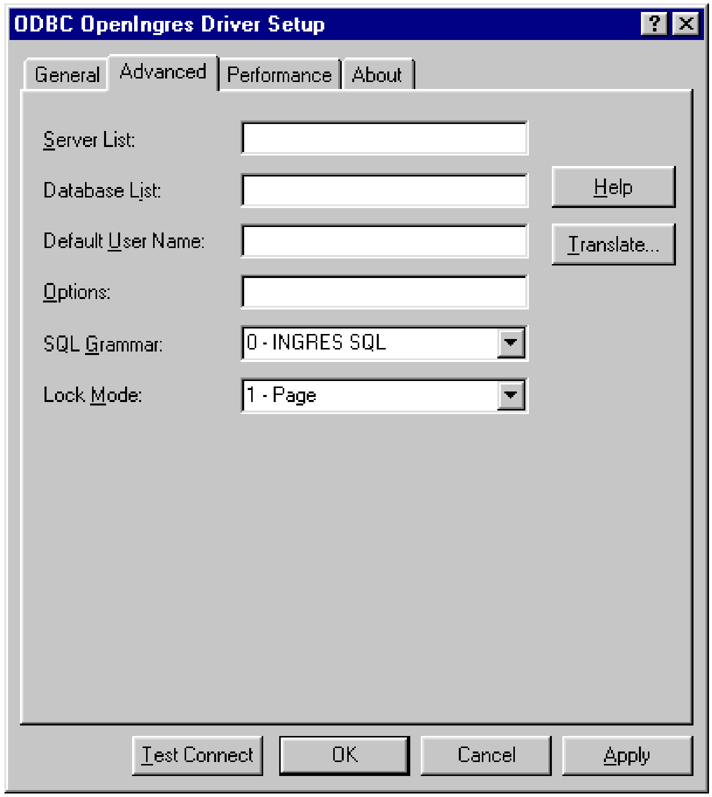
Data Source Name: A string that identifies this OpenIngres data source configuration in the system information. Examples include "Accounting" or "OINGRES-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "OINGRES on Server number 1."

Server Name: The name of the virtual node that you defined using the OpenIngres NETU utility. This virtual node tells OpenIngres which system to call, how to call it, and the user's name and password.

Database Name: The name of the database to which you want to connect by default.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following. then click **Apply.**

Server List: The list of servers (virtual nodes) that will be available in the Logon dialog box. Separate the server names with commas.

Database List: The list of databases that will be available in the logon dialog box. Separate the names with commas.

Default User Name: The default user name used to connect to your OpenIngres database. A user name is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in the logon dialog box.

Options: Any flag allowed on the OpenIngres SQL command line. Some examples are:

- -l (locks the database exclusively)
- -u (logs on as username)
- +w or -w (waits/does-not-wait for the database if a user has already opened it exclusively)
- +U or -U (enables/disables user updating of the system tables and locks the database exclusively)
- +Y or -Y (enables/disables user updating of the system tables but does not lock the database exclusively)

SQL Grammar: Provides the ability to access data sources through INGRES*Star using OpenSQL. The default is 0; that is, INGRES SQL. Specify 1 to use OpenSQL to connect to data sources through INGRES*Star.

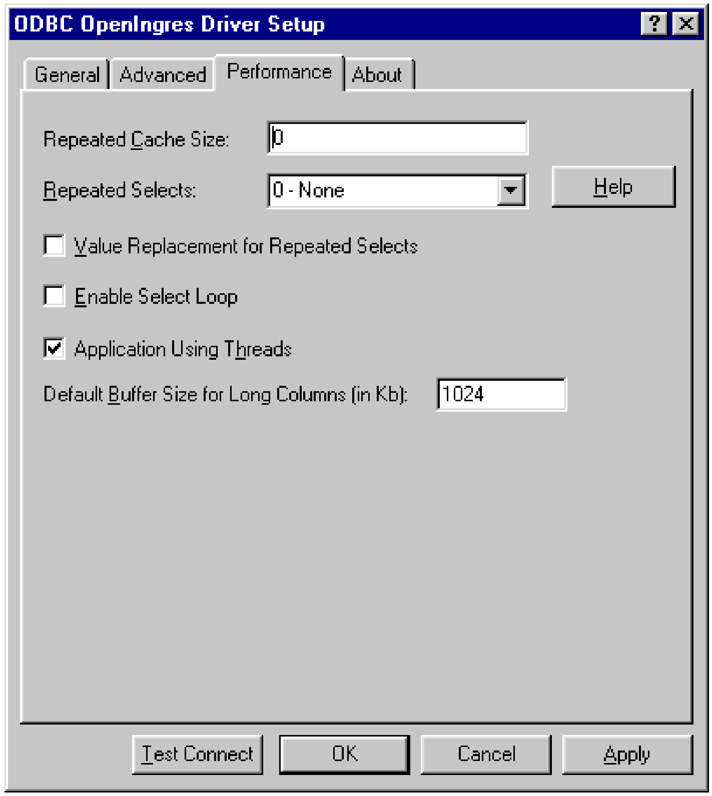
Lock Mode (OpenIngres 2.0 only): Enables locking by row, page, or table.

Century Boundary (OpenIngres 1.2 only): Century Boundary specifies the cutoff year for century inference when converting two-digit dates to four-digit dates. Two-digit dates that are less than the specified year number will be converted to 20xx. Two-digit dates greater than or equal to the number will be converted to 19xx. The default value is 20. For example, using the default value, a date of 19 will be interpreted as 2019 and a date of 21 will be interpreted as 1921. This option is necessary only when the OpenIngres 1.2 environment variable, II_DATE_FORMAT, which specifies date format, is set to convert years to two-digit numbers.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click the **Performance** tab to configure additional, optional settings for the data source.



8 Specify values for the following; then, click **Apply.**

Repeated Cache Size: An integer value that determines whether all Update and Insert statements are to be run as repeated statements. This option improves the performance of applications that repeat the same set of SQL statements. When set to 0, the default, no set of statements is repeated. The recommended setting is 100.

To repeat a single statement rather than all statements, use the OpenIngres Repeated syntax.

Repeated Selects: A value of 0, 1, or 2 that determines whether the driver optimizes Select statements or runs them as repeated queries. When set to 0, the default, the driver runs all Select statements as it did in previous versions of the product.

When set to 1, the driver optimizes Select statements that return only one result row. When set to 2, the driver runs all Select statements as repeated queries. If this attribute is set to 1 or 2, the Repeated Cache Size option must be set to greater than 0.

Setting this option to 1 or 2:

- Limits the driver to one active statement and one active connection
- Has no effect on Select statements containing a For Update clause

Value Replacement for Repeated Selects: A check box that determines whether the driver substitutes parameters for hardcoded values in repeated statements. This option is convenient in applications that do not use dynamic parameters.

When cleared (the default), the driver does not substitute parameters. When checked, the driver substitutes parameter markers for hardcoded values and the RepeatedCacheSize attribute must be greater than zero or the Repeated OpenIngres keyword must be used.

This option has no effect upon Select statements that contain a For Update clause that requires a cursor or upon statements that already use parameter markers.

This attribute supports only a subset of standard ODBC SQL grammar. It is to optimize performance and does not utilize a full SQL parser. For example, subselects are not supported, and use of "is NULL" for columns other than character columns is not supported.

Enable Select Loop: Enables the retrieval of multiple rows using the select loop model instead of cursors. The default is 0; that is, use cursors. Specify 1 to use select loops.

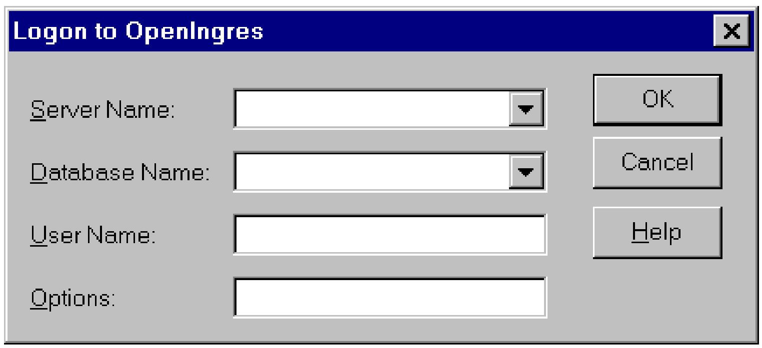
Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Default Buffer Size for Long Columns (in Kb): An integer value that specifies, in 1024-byte multiples, the maximum amount of data that will be transferred to the client for unbound long data result columns. The default is 1024; that is, 1024 * 1024 = 1 MB.

9. Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For OpenIngres, the dialog box is as follows:



In this dialog box, do the following:

1. Type the server name of the computer containing the OpenIngres database you want to access or select the name from the Server Name drop-down list, which displays the server names you specified in the setup dialog box. Server Name must be a valid virtual node that has been added using the OpenIngres NETU utility.
2. Type the name of the database to which you want to connect or select the name from the Database Name drop-down list box, which displays the names you specified in the Setup dialog box.
3. If required, type your user name.
4. Type any options for the connection. The options can be any flags allowed on the OpenIngres SQL command line. See Table 7-1 for examples of the flags allowed.

5 Click **OK** to log on to OpenIngres and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

DSN=*data_source_name*[;*attribute=value*[;*attribute=value*]...]

An example of a connection string for OpenIngres is:

```
DSN=INGRES TABLES;SRVR=QESERV;DB=PAYROLL;UID=JOHN
```

Table 7-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 7-1. OpenIngres Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.
CenturyBoundary (CB) *OpenIngres 1.2 only*	CenturyBoundary=20. Century Boundary specifies the cutoff year for century inference when converting two-digit dates to four-digit dates. Two-digit dates that are less than the specified year number will be converted to 20xx. Two-digit dates greater than or equal to the number will be converted to 19xx. The default value is 20. For example, using the default value, a date of 19 will be interpreted as 2019 and a date of 21 will be interpreted as 1921. This option is necessary only when the OpenIngres 1.2 environment variable, II_DATE_FORMAT, which specifies date format, is set to convert years to two-digit numbers.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies an OpenIngres data source configuration in the system information. Examples include "Accounting" or "INGRES-Serv1."
DefaultLongData BuffLen (DLDBL)	An integer value that specifies, in 1024-byte multiples, the maximum amount of data that will be transferred to the client for unbound long data result columns. The default is 1024 (DefaultLongDataBuffLen=1024); that is, 1024 * 1024 = 1 MB.

Table 7-1. OpenIngres Connection String Attributes (cont.)

Attribute	Description
EnableSelectLoop	EnableSelectLoop={0 | 1}. This attribute enables the retrieval of multiple rows using the select loop model instead of cursors. The default is 0; that is, use cursors. Specify 1 to use select loops.
LockMode (LM) *OpenIngres 2.0 only*	LockMode={0 | 1 | 2}. Allows you to select row, page, or table locking. Options are Row (0), Page (1), or Table (2). The default is page locking (1).
LogonID (UID)	The default logon ID (user name) used to connect to your OpenIngres database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID.
Options (OPTS)	The flags allowed on the OpenIngres SQL command line. Some examples are: ■ -l (locks the database exclusively) ■ -u (logs on as username) ■ +w or -w (waits/does-not-wait for the database if someone has already opened it exclusively) ■ +U or -U (enables/disables user updating system tables and locks the database exclusively) ■ +Y or -Y (enables/disables user updating system tables but does not lock the database exclusively)

Table 7-1. OpenIngres Connection String Attributes (cont.)

Attribute	Description
RepeatedCache Size (RCS)	An integer value that determines whether all Update and Insert statements are to be run as repeated statements. This attribute improves the performance of applications that repeat the same set of SQL statements. When set to 0, the initial default, no statements are repeated. The recommended setting for this attribute is 100 (RepeatedCacheSize=100). To repeat a single statement rather than all statements, use the OpenIngres Repeated syntax.
RepeatedSelects (RS)	RepeatedSelects={0 | 1 | 2}. This attribute determines whether the driver optimizes Select statements or runs them as repeated queries. When set to 0, the initial default, the driver runs all Select statements as it did in previous versions of the product. When set to 1, the driver optimizes Select statements that return only one result row. When set to 2, the driver runs all Select statements as repeated queries. If this attribute is set to 1 or 2, the RepeatedCacheSize attribute must be set to greater than 0. Setting this option to 1 or 2: ■ Limits the driver to one active statement and one active connection ■ Has no effect on Select statements containing a For Update clause
ServerName (SRVR)	The name of the virtual node that you defined using the OpenIngres NETU utility. This virtual node tells OpenIngres which system to call, how to call it, and the user's name and password.
SQLGrammar (SG)	SQLGrammar={0 | 1}. Provides the ability to access data sources using OpenSQL. The default is 0; that is, INGRES SQL.

Table 7-1. OpenIngres Connection String Attributes (cont.)

Attribute	Description
ValueReplacement (VR)	ValueReplacement={0 | 1}. This attribute determines whether the driver substitutes parameters for hardcoded values in repeated statements. This option is convenient in applications that do not use dynamic parameters. When set to 0, the initial default, the driver does not substitute parameters. When set to 1, the driver substitutes parameter markers for hardcoded values and the RepeatedCacheSize attribute must be greater than zero or the Repeated OpenIngres keyword must be used. This option has no effect upon Select statements that contain a For Update clause that requires a cursor or upon statements that already use parameter markers. This attribute supports only a subset of standard ODBC SQL grammar. It is intended for performance and does not utilize a full SQL parser. For example, subselects are not supported, and use of "is NULL" for columns other than character columns is not supported.

Data Types

Table 7-2 shows how OpenIngres data types map to the standard ODBC data types.

Table 7-2. OpenIngres Data Types

OpenIngres	ODBC
Byte*	SQL_BINARY
Byte varying*	SQL_VARBINARY
Char	SQL_CHAR
Date	SQL_TYPE_TIMESTAMP
Float	SQL_DOUBLE
Float4	SQL_REAL
Integer	SQL_INTEGER
Integer1	SQL_TINYINT
Long byte*	SQL_LONGVARBINARY
Long varchar*	SQL_LONGVARCHAR
Money*	SQL_DECIMAL
Smallint	SQL_SMALLINT
Varchar	SQL_VARCHAR

* Not supported by OpenSQL.

Note: OpenIngres Date values do not directly map to the ODBC type SQL_TYPE_TIMESTAMP. If interval data is placed in Date columns, then the driver raises an error when attempting to read the value.

Isolation and Lock Levels Supported

OpenIngres supports isolation level 1 (read committed, the default). OpenIngres supports page-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the OpenIngres drivers. SQLProcedures and SQLProcedureColumns are supported unless SQLGrammar=1.

The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The OpenIngres database system supports multiple connections and multiple statements per connection.

Note: If you set the RepeatedSelects connection string attribute to 1 or 2, the driver is limited to one active statement and one active connection.

8 Connect ODBC for Oracle

Connect ODBC for Oracle supports two separate drivers. Connect ODBC for Oracle (the "Oracle driver") supports the Oracle7 database system. The Oracle driver is supported in the Windows 9*x*, Windows NT, and UNIX environments.

Connect ODBC for Oracle8 (the "Oracle8 driver") supports the Oracle8 database system. It also supports the Oracle7 database system version 7.3.4 or higher when using the Oracle Net8 client. The Oracle8 driver is supported in the Windows 9*x*, Windows NT, and UNIX environments.

See the README file shipped with your DataDirect product for the file names of the Oracle drivers.

System Requirements

The following section lists requirements for all supported platforms.

Windows 9*x* and Windows NT

Both Oracle and Oracle8 client information for Windows 9*x* and Windows NT is listed below.

Important: You must have *all* components of the Oracle client software installed; otherwise, the driver will not operate properly.

Oracle

The Oracle SQL*Net product is required to access remote Oracle7 databases. The appropriate DLLs for the current version of SQL*Net and OCIW32.DLL must be on your path. For example, SQL*Net 2.3 requires ORA73.DLL, CORE35.DLL, NLSRTL32.DLL, and CORE35O.DLL, as well as OCIW32.DLL.

Oracle8

The Oracle Net8 Client 8.0.4, or higher, is required to access remote Oracle8 databases (servers) 8.0.3 or higher. On Intel systems, the appropriate DLLs for the Oracle Net8 Client must be on your path, for example, ORA804.DLL, PLS804.DLL, and OCI.DLL.

The Oracle Net8 Client 8.0.4, or higher, is required to access remote Oracle databases (servers) 7.3.4.*x*.

Enabling MTS

The Oracle8 driver can take advantage of Microsoft Transaction Server (MTS) capabilities, specifically, the Distributed Transaction Coordinator (DTC). Refer to the help file of the "MicroSoft Transaction Server SDK" for details. You must be accessing 8.0.4 or higher servers using Net8 Client 8.0.5.1.0 or higher.

UNIX

Both Oracle and Oracle8 client information for UNIX is listed below.

Important: You must have *all* components of the Oracle client software installed; otherwise, the driver will not operate properly. See the DataDirect README for a component list.

Oracle and Oracle8

Before you can use the Oracle data source, you must have the Oracle SQL*Net or Net8 drivers you plan to use installed on your workstation in the $ORACLE_HOME source tree. ORACLE_HOME is an environment variable created by the Oracle installation process that identifies the location of your Oracle client components.

Oracle refers to the runtime Oracle component as "Oracle RDBMS." From the Oracle RDBMS product, the Oracle driver depends on the executables in $ORACLE_HOME/bin and the interface libraries in $ORACLE_HOME/rdbms/lib.

Set the environment variable ORACLE_HOME to the directory where you installed the Oracle RDBMS, SQL*Net, or Net8 product. For example, for C-shell users, the following syntax is valid:

```
setenv ORACLE_HOME /databases/oracle
```

For Bourne- or Korn-shell users, the following syntax is valid:

```
ORACLE_HOME=/databases/oracle;export ORACLE_HOME
```

Building the Required Oracle7 SQL*Net Shared Library

The Oracle driver requires a one-time site linking to build an Oracle7 SQL*Net driver on AIX and, for Oracle7.1 only, on Solaris and HP-UX. This site linking binds your unique Oracle7 SQL*Net configuration into the file, which is used by the Oracle driver to access local and remote Oracle databases.

Before you build the Oracle7 SQL*Net shared library, install Oracle and set the environment variable ORACLE_HOME to the directory where you installed Oracle. Connect ODBC provides a script, genclntsh, that builds the Oracle7 SQL*Net driver. This script is in the scr/oracle directory.

The following command builds the Oracle7 SQL*Net shared library:

```
genclntsh
```

Building the Required Oracle Net8 Shared Library on Solaris

Under Oracle 8.0.3 or 8.0.4 for Solaris, the Oracle8 driver requires a one-time site linking to build a replacement Oracle Net8 driver. This site linking binds your unique Oracle Net8 configuration into the file, which is used by the Oracle driver to access local and remote Oracle databases.

The Oracle8 driver requires the shared library libclntsh.so, which is built by the Oracle script genclntsh. The genclntsh script provided by Oracle causes an error resulting from the undefined symbol slpmprodstab. Oracle8 users must therefore use the genclntsh8 script provided with Connect ODBC to build a replacement libclntsh.so. This script, in the scr/oracle directory, places the new libclntsh.so in ../../lib, which is your $ODBC_HOME/lib directory; it does not overwrite the original libclntsh.so in the $ORACLE_HOME/lib directory.

Before you build the Oracle Net8 shared library, install Oracle and set the environment variable ORACLE_HOME to the directory where you installed Oracle.

The following command builds the Oracle Net8 shared library:

```
genclntsh8
```

Warning: Oracle8 users will have the original libclntsh.so library in the $ORACLE_HOME/lib directory. Therefore, the $ODBC_HOME/lib directory, containing the correct library, *must* be on the LD_LIBRARY_PATH *before* $ORACLE_HOME/lib. Otherwise, the original Oracle library will be loaded, resulting in the unresolved symbol error.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

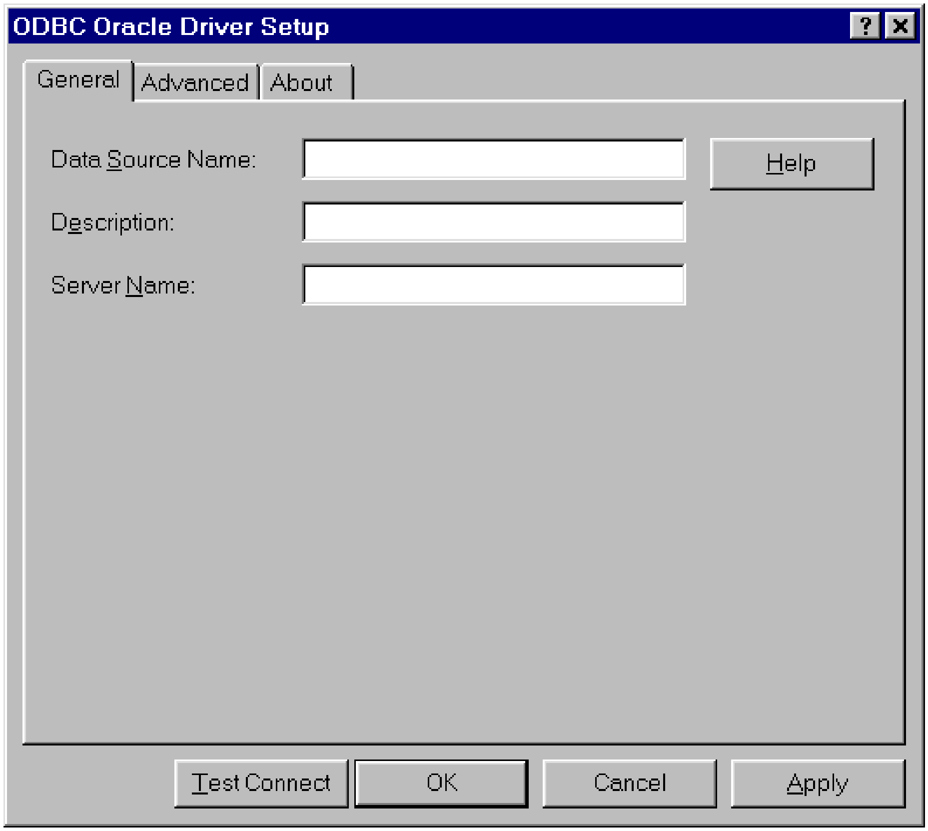
In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 8-1. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure an Oracle data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Oracle Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the Oracle driver of your choice and click **Finish** to display the ODBC Oracle Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 184 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

Verify that all required client software is properly installed. If it is not, you will see the message:

```
Specified driver could not be loaded due to
system error [xxx].
```

Click **OK**.

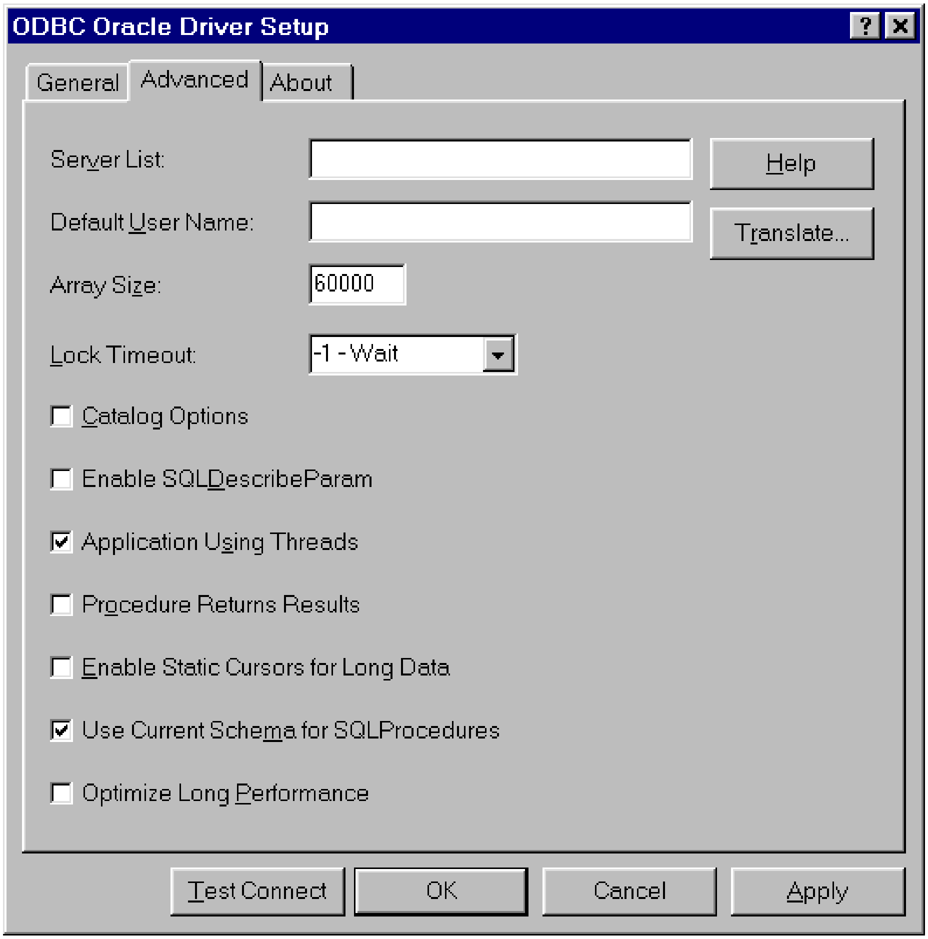
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Oracle data source configuration in the system information. Examples include "Accounting" or "Oracle-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "Oracle on Server number 1."

Server Name: The client connection string designating the server and database to be accessed. The information required varies depending on the client driver you are using. "Connecting to a Data Source Using a Connection String" on page 185 describes the format of the connection string.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Server List: The list of client connection strings that will appear in the logon dialog box. Separate the strings with commas. If the client connection string contains a comma, enclose it in quotation marks; for example, "Serv,1", "Serv,2", "Serv,3."

Default User Name: The default user name used to connect to your Oracle database. A default user name is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in the logon dialog box or connection string.

Array Size: The number of bytes the driver uses for fetching multiple rows. Values can be an integer from 1 up to 4 GB; the default is 60000. Larger values increase throughput by reducing the number of times the driver fetches data across the network. Smaller values increase response time, as there is less of a delay waiting for the server to transmit data.

Lock Timeout: A value of 0 or -1 that specifies whether Oracle should wait for a lock to be freed before raising an error when processing a Select...For Update statement. Values can be -1 (wait forever) or 0 (do not wait). The default is -1-Wait.

Packet Size (Oracle7 Only): A value that controls the packet size for TCP/IP connections. Specify one of the following packet sizes: 1024, 2048, 4096, or 8192. Any other value is ignored.

The Packet Size option is used only when the connection string specified in the Server Name option is T for TCP/IP as the driver prefix. See the ServerName option described in Table 8-1.

Catalog Options: Check this box if you want the result column REMARKS for the catalog functions SQLTables and SQLColumns, and COLUMN_DEF for the catalog function SQLColumns to have meaning for Oracle. Checking this box reduces the performance of your queries. The default is unchecked, which returns SQL_NULL_DATA for the result column COLUMN_DEF and REMARKS columns.

Enable SQLDescribeParam: Check this box to enable the SQLDescribeParam function, which results in all parameters being described with a data type of SQL_VARCHAR. This option should be checked when using Microsoft Remote Data Objects (RDO) to access data. The default is unchecked.

Application Using Threads: Check this box to ensure that the driver works with multi-threaded applications. When using the driver with single-threaded applications, clear this check box. Turning off this setting avoids additional processing required for ODBC thread-safety standards. The default is checked.

Oracle7 only: When Application Using Threads is enabled, SQLGetInfo(SQL_ASYNC_MODE) returns SQL_AM_NONE, SQLSetConnectAttr(SQL_ATTR_ASYNC_ENABLE) returns "optional feature not implemented," and SQLSet/GetStmtAttr(SQL_ATTR_ASYNC_ENABLE) returns "optional feature not implemented." Asynchronous execution is not supported by the Oracle client in a multi-threaded environment.

Procedure Returns Results: Check this box to enable the driver to return result sets from stored procedures/functions. If this option is on and you execute a stored procedure that does not return result sets, you will incur a small performance penalty. See "Stored Procedure Results" on page 191 for details. The default is unchecked.

Enable Static Cursors for Long Data: Check this box to enable the driver to support long columns when using a static cursor. Using this option causes a performance penalty at the time of execution when reading long data. The default is unchecked.

Use Current Schema for SQLProcedures: Check this box to specify only the current user when executing SQLProcedures. When this option is enabled the call for SQLProcedures is optimized, but only procedures owned by the user are returned. The default is checked.

Optimize Long Performance (Oracle8 only): Check this box to fetch long data directly into the application’s buffers rather than allocating buffers and making a copy. This option, when enabled, decreases fetch times on long data; however, it can cause the application to be limited to one active statement per connection. The default is unchecked.

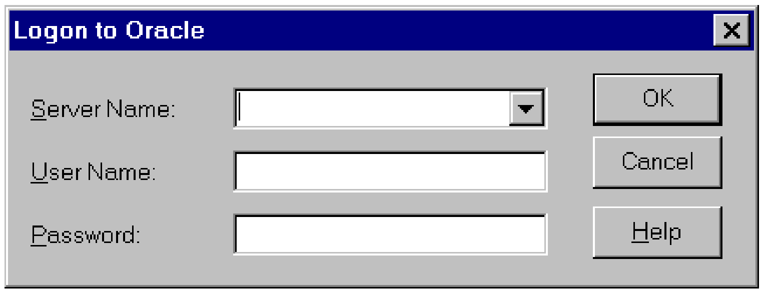
Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM TO ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For Oracle, the dialog box is as follows:



In this dialog box, do the following:

1. Type the client connection string of the computer containing the Oracle database tables you want to access or select the string from the Server Name drop-down list box, which displays the names you specified in the setup dialog box.
2. If required, type your Oracle user name.
3. If required, type your Oracle password.
4. Click **OK** to log on to the Oracle database installed on the server you specified and to update the values in the system information.

Note: Oracle has a feature that allows you to connect to Oracle via the operating system user name and password. To connect, use a slash (/) for the user name and leave the password blank. To configure the Oracle server/client, refer to the Oracle server documentation.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Oracle is:

```
DSN=Accounting;SRVR=X:QESRVR;UID=JOHN;PWD=XYZZY
```

If the server name contains a semicolon, enclose it in quotation marks:

```
DSN=Accounting;SRVR="X:QE;SRVR";UID=JOHN;PWD=XYZZY
```

Table 8-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 8-1. Oracle Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread-safety standards. **Oracle7 only:** When you specify ApplicationUsingThreads=1, SQLGetInfo(SQL_ASYNC_MODE) returns SQL_AM_NONE, SQLSetConnectAttr(SQL_ATTR_ASYNC_ENABLE) returns "optional feature not implemented," and SQLSet/GetStmtAttr(SQL_ATTR_ASYNC_ENABLE) returns "optional feature not implemented." Asynchronous execution is not supported by the Oracle client in a multi-threaded environment.
ArraySize (AS)	The number of bytes the driver uses for fetching multiple rows. Values can be an integer from 1 up to 4 GB. The default is 60,000. Larger values increase throughput by reducing the number of times the driver fetches data across the network. Smaller values increase response time, as there is less of a delay waiting for the server to transmit data.
CatalogOptions (CO)	CatalogOptions={0 | 1}. Specifies whether the result column REMARKS for the catalog functions SQLTables and SQLColumns and COLUMN_DEF for the catalog function SQLColumns have meaning for Oracle. If you want to obtain the actual default value, set CO=1. The default is 0.
DataSourceName (DSN)	A string that identifies an Oracle data source configuration in the system information. Examples include "Accounting" or "Oracle-Serv1."

***Table 8-1. Oracle Connection String Attributes** (cont.)*

Attribute	Description
EnableDescribe Param (EDP)	EnableDescribeParam={0 | 1}. Enables the ODBC API function SQLDescribeParam, which results in all parameters being described with a data type of SQL_VARCHAR. This option should be set to 1 when using Microsoft Remote Data Objects (RDO) to access data. The default is 0.
EnableStatic CursorsForLong Data (ESCLD)	EnableStaticCursorsForLongData={0 | 1}. Enables the driver to support long columns when using a static cursor. Using this option causes a performance penalty at the time of execution when reading long data. The default is 0.
LockTimeOut (LTO)	A value that specifies whether Oracle should wait for a lock to be freed before raising an error when processing a Select...For Update statement. Values can be -1 (wait forever, the default) or 0 (do not wait).
LogonID (UID)	The logon ID (user name) that the application uses to connect to your Oracle database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID. See "Connecting to a Data Source Using a Logon Dialog Box" on page 184 for details.
OptimizeLong Performance (OLP) *Oracle8 Only*	OptimizeLongPerformance={0 | 1}. Enables the driver to fetch long data directly into the application's buffers rather than allocating buffers and making a copy. This option, when enabled, decreases fetch times on long data; however, it can cause the application to be limited to one active statement per connection. The default is 0.
PacketSize (PS) *Oracle7 Only*	PacketSize={1024 | 2048 | 4096 | 8192}. A value that controls the packet size for TCP/IP connections. Any values other than 1024, 2048, 4096, or 8192 are ignored. This value is used only when the ServerName attribute (described above) is set to T for TCP/IP.

Table 8-1. Oracle Connection String Attributes (cont.)

Attribute	Description
Password (PWD)	The password that the application uses to connect to your Oracle database. See "Connecting to a Data Source Using a Logon Dialog Box" on page 184 for details.
ProcedureRet Results (PRR)	ProcedureRetResults={0 | 1}. Values are Off (0) and On (1). The default is 0. When the option is on, the driver will return result sets from stored procedures/functions. If this option is on and you execute a stored procedure that does not return result sets, you will incur a small performance penalty. See "Stored Procedure Results" on page 191 for details.
ServerName (SRVR)	The client connection string designating the server and database to be accessed. The information required varies depending on the client driver that you are using. For Oracle7 remote servers, the SQL*Net connection string has the following form: `driver_prefix:computer_name[:sid]` `driver_prefix:computer_name[:sid]` *driver_prefix* identifies the network protocol being used. The driver prefix can be as follows: P (named pipes), X (SPX), B (NetBIOS), T (TCP/IP), D (DECNet), A (Oracle Async), AT (AppleTalk), or TNS (SQL*Net 2.0). Check your Oracle documentation for other protocols. *computer_name* is the name of the Oracle Listener on your network. *sid* is the Oracle System Identifier and refers to the instance of Oracle running on the host. This item is required when connecting to systems that support more than one instance of an Oracle database.

Table 8-1. Oracle Connection String Attributes *(cont.)*

Attribute	Description

ServerName (SRVR) *continued*	For local servers, the SQL*Net connection string has the form:
	`database_name`
	database_name identifies your Oracle database.
	If the SQL*Net connection string contains semicolons, enclose it in quotation marks. See your SQL*Net documentation for more information.
	Oracle8
	For Oracle8 remote servers, the Net8 Client connection string has the following form:
	`TNSNAME`
	TNSNAME is the alias name of the Oracle Listener on your network.
	If the Net8 Client connection string contains semicolons, enclose it in quotation marks. See your Net8 Client documentation for more information.

UseCurrentSchema (UCS)	UseCurrentSchema={0 | 1}. Enables the driver to specify only the current user when executing SQLProcedures. When this option is set to 1 (on), the call for SQLProcedures is optimized, but only procedures owned by the user are returned. The default is 1.

Oracle Data Types

Table 8-2 shows how the Oracle data types are mapped to the standard ODBC data types.

Table 8-2. Oracle Data Types

Oracle	ODBC
Char	SQL_CHAR
Date	SQL_TYPE_TIMESTAMP
Long	SQL_LONGVARCHAR
Long Raw	SQL_LONGVARBINARY
Number	SQL_DOUBLE
Number(p,s)	SQL_DECIMAL
Raw	SQL_VARBINARY
Varchar2	SQL_VARCHAR

Oracle8

Table 8-3 shows how, when connecting to Oracle8 servers , the following additional Oracle8 data types are mapped to the standard ODBC data types. These data types support output parameters to stored procedures.

Table 8-3. Oracle8 Data Types

Oracle8	ODBC
Bfile	SQL_LONGVARBINARY*
Blob	SQL_LONGVARBINARY
Clob	SQL_LONGVARCHAR

* Read-Only

The Oracle8 driver does not support any Abstract Data Types. When the driver encounters an Abstract Data Type during data retrieval, it will return an Unknown Data Type error (SQL State HY000). It also does not support asynchronous operations, due to constraints in the current Oracle8 client.

Stored Procedure Results

When the option Procedure Returns Results is active, the driver returns result sets from stored procedures/functions. In addition, SQLGetInfo(SQL_MULT_RESULTS_SETS) will return "Y" and SQLGetInfo(SQL_BATCH_SUPPORT) will return SQL_BS_SELECT_PROC. If this option is on and you execute a stored procedure that does not return result sets, you will incur a small performance penalty.

This feature requires that stored procedures be in a certain format. First, a package must be created to define all of the cursors used in the procedure, then the procedure can be created using the new cursor. For example:

```
Create or replace package GEN_PACKAGE as
   CURSOR G1 is select CHARCOL from GTABLE2;
   type GTABLE2CHARCOL is ref cursor return G1%rowtype;
end GEN_PACKAGE;

Create or replace procedure GEN_PROCEDURE1 (
   rset IN OUT GEN_PACKAGE.GTABLE2
   CHARCOL, icol INTEGER) as
begin
   open rset for select CHARCOL from GTABLE2
      where INTEGERCOL <= icol order by INTEGERCOL;
end;
```

When executing the stored procedures with result sets, do not include the result set arguments in the list of procedure arguments. The previously described example would be executed as:

```
{call GEN_PROCEDURE1 (?)}
```

where ? is the parameter for the icol argument.

For more information consult your Oracle SQL manual.

Isolation and Lock Levels Supported

Oracle supports isolation level 1 (read committed) and isolation level 3 (serializable isolation—if the server version is Oracle7.3 or higher, or Oracle8.*x*). Oracle supports record-level locking.

See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Oracle drivers. They support SQLSetPos as well as scrollable cursors with SQLFetchScroll and SQLExtendedFetch. The drivers also support SQLDescribeParam if EnableDescribeParam=1.

The Oracle drivers support the following functions:

- SQLProcedures
- SQLProcedureColumns
- SQLPrimaryKeys
- SQLForeignKeys
- SQLTablePrivileges
- SQLColumnPrivileges
- SQLSetPos (SQL_ADD)

The drivers support the core SQL grammar.

Number of Connections and Statements Supported

The Oracle drivers support multiple connections and multiple statements per connection.

9 Connect ODBC for Paradox

Connect ODBC for Paradox (the "Paradox driver") supports Paradox 3*x*, 4*x*, 5.*x*, 7.*x*, 8.*x*, and 9.0 tables in the Windows 9*x* and Windows NT environments.

See the README file shipped with your MERANT DataDirect product for the file name of the Paradox driver.

System Requirements

To use the Paradox driver, you must install the Borland Database Engine, which conforms to the IDAPI programming interface. The Borland Database Engine can be found in any of the following software packages:

- Borland C++ for Windows NT or Windows 9*x*
- Delphi for Windows NT or Windows 9*x*
- Paradox 7, 8, or 9 for Windows NT or Windows 9*x*

You must have IDAPI32.DLL on your path or in your Windows 9*x* \SYSTEM directory or Windows NT \SYSTEM32 directory.

Multiuser Access to Tables

You can query Paradox tables that reside in a shared directory on a network or that are to be shared among applications running on a local workstation. If the tables are on a network server, multiple users can query these tables simultaneously. To share

Paradox tables among multiple users, the tables must be located in a shared directory on your network server.

Two connection attributes identify the Paradox database you are accessing: Database (database directory) and NetDir (network directory). The Database setting specifies the directory of Paradox tables that is the database. If the Database setting you specify is a shared network directory, then Paradox requires a NetDir specification as well. This value identifies the directory containing the PARADOX.NET file that corresponds to the Database setting you have specified.

Every user who accesses the same shared directory of tables must set the NetDir value to point to the same PARADOX.NET file. If your connection string does not specify a NetDir value, then Paradox uses the NetDir value specified in the Paradox section of the IDAPI configuration file. This makes it important that the NetDir specification in each user's IDAPI configuration file be set correctly.

Whenever you open a Paradox table that another user opens at the same time, the consistency of the data becomes an issue if both individuals are updating the table.

Locking

The Paradox driver has two locking levels: record locking and table locking. Tables that have no primary key always have a prevent write lock placed on the table when the table is opened. The table lock is escalated to a write lock when an operation that changes the table is attempted.

Tables that have primary keys use record locking. The locking level is escalated from record locking to a table write lock if the transaction runs out of record locks.

Primary keys provide the greatest concurrency for tables that are accessed and modified by multiple users.

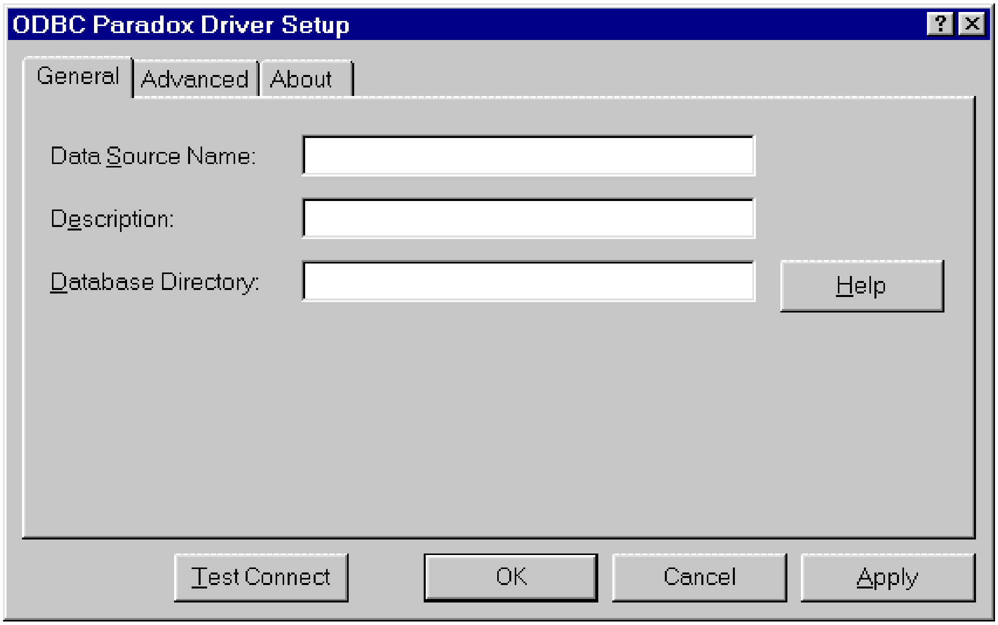
Note: If a table lock is placed on a Paradox table, the Paradox driver prevents users from updating and deleting records but does not prevent them from inserting records into the locked table.

Configuring Data Sources

Data sources are configured and modified through the ODBC Administrator. To configure a Paradox data source:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Paradox Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the Paradox driver and click **Finish** to display the ODBC Paradox Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

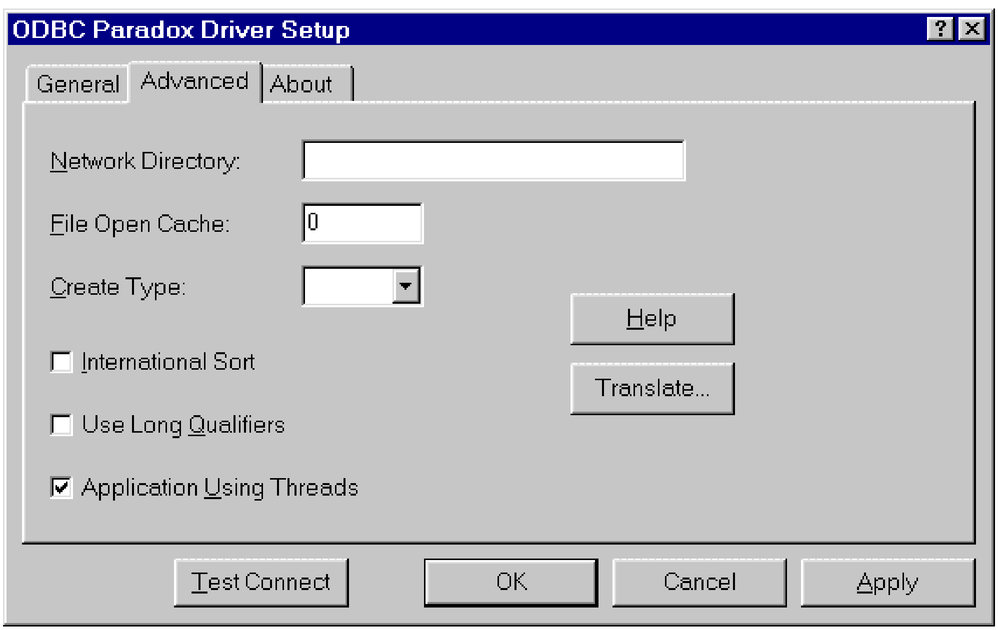
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Paradox data source configuration in the system information. Examples include "Accounting" or "Paradox-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "Paradox Files on Server number 1."

Database Directory: The directory in which the Paradox files are stored. If a directory is not specified, the current working directory is used. You can also specify aliases that are defined in your IDAPI configuration file, if you have one. To do this, enclose the alias name in colons. For example, to use the alias MYDATA, specify ":MYDATA:"

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Network Directory: The directory containing the PARADOX.NET file that corresponds to the database you have specified. If the Paradox database you are using is shared on a network, then every user who accesses it must set this value to point to the same PARADOX.NET file. If not set here, this value is determined by the NetDir setting in the Paradox section of the IDAPI configuration file. If you are not sure how to set this value, contact your network administrator.

File Open Cache: An integer value to specify the maximum number of unused file opens to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The disadvantage is that a user who specifies file locking on open may get a locking conflict even though no one appears to have the file open. The default is 0, which means no file open caching.

Create Type: The Paradox table version used for any Create Table statements that you execute. You can specify the version from the drop-down list or leave the box blank and use the default, which is determined by the Level setting in the Paradox section of the IDAPI configuration file. The numeric values map to the major revision numbers of the Paradox family of products.

If you select Create Type 7, 8, & 9, the Paradox driver supports table names up to 128 characters long. For all other Create Type settings, the driver supports table names up to 8 characters long.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Use Long Qualifiers: Specifies whether the driver uses long path names as table qualifiers. If the Use Long Qualifiers check box is selected, path names can be up to 255 characters. The default is unselected (path names can be up to 128 characters).

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread-safety standards.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Paradox is:

```
DSN=PARADOX TABLES;DB=C:\ODBC\EMP;PW=ABC,DEF,GHI
```

Table 9-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 9-1. Paradox Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread-safety standards.
CreateType (CT)	CreateType={3 | 4 | 5 | 7 | 8 | 9 | null (blank)}. This attribute specifies the table version for Create Table statements. The numeric values map to the major revision numbers of the Paradox family of products. To override another CreateType setting chosen during data source configuration with the default create type determined by the Level setting in the Paradox section of the IDAPI configuration file, set CreateType= (null). **Note:** When CreateType is set to 7, 8, or 9, the Paradox driver supports table names up to 128 characters long. For all other CreateType settings, the driver supports table names up to 8 characters long.
Database (DB)	The directory in which the Paradox files are stored. For this attribute, you can also specify aliases that are defined in your IDAPI configuration file, if you have one. To do this, enclose the alias name in colons. For example, to use the alias MYDATA, specify "Database=:MYDATA:"
DataSourceName (DSN)	A string that identifies a Paradox data source configuration in the system information. Examples include "Accounting" or "Paradox-Serv1."

Table 9-1. Paradox Connection String Attributes (cont.)

Attribute	Description
DeferQueryEvaluation (DQ)	DeferQueryEvaluations={0 | 1}. This attribute determines when a query is evaluated—after all records are read or each time a record is fetched. If DeferQueryEvaluation=0, the driver generates a result set when the first record is fetched. The driver reads all records, evaluates each one against the Where clause, and compiles a result set containing the records that satisfy the search criteria. This process slows performance when the first record is fetched, but activity performed on the result set after this point is much faster, because the result set has already been created. You do not see any additions, deletions, or changes in the database that occur while working from this result set. If DeferQueryEvaluation=1 (the default), the driver evaluates the query each time a record is fetched, and stops reading through the records when it finds one that matches the search criteria. This setting avoids the slowdown while fetching the first record, but each fetch takes longer because of the evaluation taking place. The data you retrieve reflect the latest changes to the database; however, a result set is still generated if the query is a Union of multiple Select statements, if it contains the Distinct keyword, or if it has an Order By or Group By clause.
FileOpenCache (FOC)	The maximum number of unused table opens to cache. For example, when FileOpenCache=4, and a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of using file open caching is increased performance. The disadvantage is that a user who tries to open the table exclusively may get a locking conflict even though no one appears to have the table open. The initial default is 0.

Table 9-1. Paradox Connection String Attributes (cont.)

Attribute	Description
IntlSort (IS)	IntlSort={0 | 1}. This attribute determines the order that records are retrieved when you issue a Select statement with an Order By clause. If IntlSort=0 (the initial default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If IntlSort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.
NetDir (ND)	The directory containing the PARADOX.NET file that corresponds to the database you have specified. If the Paradox database you are using is shared on a network, then every user who accesses it must set this value to point to the same PARADOX.NET file. If not specified, this value is determined by the NetDir setting in the Paradox section of the IDAPI configuration file. If you are not sure how to set this value, contact your network administrator.
Passwords (PW)	A password or list of passwords. You can add 1 to 50 passwords into the system using a comma-separated list of passwords. Passwords are case-sensitive. For example, Passwords=psw1, psw2, psw3.
UltraSafeCommit (USF)	UltraSafeCommit={0 | 1}. This attribute determines when the driver flushes its changes to disk. If UltraSafeCommit=1, the driver does this at each COMMIT. This decreases performance. The default is 0. This means that the driver flushes its changes to disk when the table is closed or when internal buffers are full. In this case, a machine "crash" before closing a table may cause recent changes to be lost.
UseLongQualifiers (ULQ)	UseLongQualifiers={0 | 1}. This attribute specifies whether the driver uses long path names as table qualifiers. With UseLongQualifiers set to 1 path names can be up to 255 characters. The default is 0; maximum length is 128 characters.

Data Types

Table 9-2 shows how the Paradox data types are mapped to the standard ODBC data types. It also identifies the types supported by Paradox versions 3.*x* and 4.*x*. These Paradox data types can be used in a Create Table statement. See Appendix A, "SQL for Flat-File Drivers," on page 377 for the syntax of the Create Table statement.

Table 9-2. Paradox Data Types

Paradox	ODBC	3.*x* Support	4.*x* Support
Alpha	SQL_CHAR	Yes	Yes
AutoIncrement	SQL_INTEGER	No	No
BCD	SQL_DECIMAL	No	No
Binary*	SQL_LONGVARBINARY	No	Yes
Bytes*	SQL_BINARY	No	No
Date	SQL_TYPE_DATE	Yes	Yes
Formatted Memo*	SQL_LONGVARBINARY	No	Yes
Graphic*	SQL_LONGVARBINARY	No	Yes
Logical*	SQL_BIT	No	No
Long Integer	SQL_INTEGER	No	No
Memo*	SQL_LONGVARCHAR	No	Yes
Money	SQL_DOUBLE	Yes	Yes
Number	SQL_DOUBLE	Yes	Yes
OLE*	SQL_LONGVARBINARY	No	Yes
Short	SQL_SMALLINT	Yes	No
Time	SQL_TYPE_TIME	No	No
TimeStamp	SQL_TYPE_TIMESTAMP	No	No

* Cannot be used in an index. Of the starred types, only Logical can be used in a Where clause.

Select Statement

You use a SQL Select statement to specify the columns and records to be read. All of the Select statement clauses described in Appendix A, "SQL for Flat-File Drivers," on page 377 are supported by the Paradox driver. This section describes the information that is specific to the Paradox driver.

Column Names

Paradox column names are case-insensitive and their maximum length is 25 characters. If a column name contains a special character, does not begin with a letter, or is a reserved word, surround it with the grave character (`) (ASCII 96). For example:

```
SELECT `last name` FROM emp
```

Alter Table Statement

The Paradox driver supports the Alter Table statement to add one or more columns to a table or to delete (drop) a single column.

The Alter Table statement has the form:

```
ALTER TABLE table_name {ADD column_name data_type
[DEFAULT default_value] | ADD (column_name data_type
[DEFAULT default_value][, column_name data_type
[DEFAULT default_value]] , , ,) | DROP
[COLUMN] column_name [CASCADE | RESTRICT]}
```

table_name is the name of the table to which you are adding or dropping columns.

column_name assigns a name to the column you are adding or specifies the column you are dropping.

data_type specifies the native data type of each column you add.

For example, to add two columns to the emp table:

```
ALTER TABLE emp (ADD startdate date, dept alphanumeric (10))
```

Dropping Columns

You cannot add columns and drop columns in a single statement, and you can drop only one column at a time.

When dropping a column, use the Cascade keyword to drop the column while removing references from any dependent objects, such as indexes or views. Use Restrict to cause the Alter Table statement to fail if other objects are dependent upon the column you are dropping. For example, to drop a column and remove its references from dependent objects:

```
ALTER TABLE emp DROP startdate CASCADE
```

If the Alter Table statement contains neither Cascade nor Restrict, it fails when you attempt to drop a column upon which other objects are dependent.

Create Table Statement

The Create Table statement is used to create database files. The form of the Create Table statement is:

```
CREATE TABLE filename (col_definition[,col_definition,. . .])
```

filename can be a simple name or a full name. A simple file name is preferred for portability to other SQL data sources. If it is a simple file name, the file is created in the directory you specified as the database directory in the connection string. If you did not specify a database directory in the connection string, the file is created in the directory you specified as the database directory in the system information. If you did not specify a database directory in either place, the file is created in the current working directory at the time you connected to the driver.

col_definition is the column name, followed by the data type, Default clause, followed by an optional column constraint definition. Values for column names are database specific. The data type specifies a column's data type.

The only column constraint definition currently supported by some flat-file drivers is "not null." Not all flat-file tables support "not null" columns. In the cases where "not null" is not supported, this restriction is ignored and the driver returns a warning if "not null" is specified for a column. The "not null" column constraint definition is allowed in the driver so that you can write a database-independent application (and not be concerned about the driver raising an error on a Create Table statement with a "not null" restriction).

A sample Create Table statement to create an employee database table is:

```
CREATE TABLE emp (last_name CHAR(20) NOT NULL DEFAULT 'JOHNSON',
first_name CHAR(12) NOT NULL,salary NUMERIC (10,2) NOT NULL,
hire_date DATE NOT NULL)
```

Password Protection

Paradox supports two types of passwords: master and auxiliary. The Paradox driver supports master passwords only and can manage up to 50 passwords.

Paradox tables can be encrypted to provide limited access to users who do not know the password. The driver maintains a list of passwords for each connection. The driver can access only encrypted tables for which a password appears in this list. You can supply a password in three ways: by typing it in the Password dialog box (which appears when the driver does not have the password to open an encrypted table), by including it in a connection string (with the Passwords attribute), or by using the Add Password statement.

Paradox provides five statements that manage passwords for Paradox tables. These statements are specific to the Paradox driver:

```
ENCRYPT filename USING PASSWORD password
ADD PASSWORD password
DECRYPT filename USING PASSWORD password
REMOVE PASSWORD password
REMOVE ALL PASSWORDS
```

filename can be a simple filename or a full pathname. If a simple filename is given, the file must be in the directory specified with the Database connection string attribute. The .DB extension is not required.

password is a case-sensitive text string up to 15 characters in length, including blanks. If your password includes lower-case letters or nonalphanumeric characters, enclose it in single quotation marks (').

Encrypting a Paradox Table

The Encrypt statement associates a password with a table. For example:

```
ENCRYPT emp USING PASSWORD test
```

Accessing an Encrypted Paradox Table

To access an encrypted Paradox table, add the password to the list of passwords Paradox maintains for that connection. To do so, you can:

- Issue an Add Password statement before you access the table. For example:

  ```
  ADD PASSWORD test
  SELECT * FROM emp
  ```

- Specify the passwords using the Passwords attribute at connection time.

If you do not add the password, the driver prompts you for it when you access the table.

Decrypting a Paradox Table

The Decrypt statement disassociates a password from a table. You no longer need to enter the password to open the table. For example:

```
DECRYPT emp USING PASSWORD test
```

Removing a Password from Paradox

The Remove Password statement removes a password from the list Paradox maintains for the connection. For example:

```
REMOVE PASSWORD test
```

Removing All Passwords from Paradox

The Remove All Passwords statement removes the list of passwords Paradox maintains.

If you remove a password from Paradox and do not decrypt the table, you must continue entering the password to open the table.

Index Files

An index is used to read records in sorted order and to improve performance when selecting records and joining tables. Paradox indexes are stored in separate files and are either *primary* or *non-primary*.

Primary Index

A primary index is made up of one or more fields from the Paradox table. The primary key fields of a primary index consist of one or more consecutive fields in the table, beginning with the first field in the table. A table can have only one primary index.

Collectively, the primary key fields uniquely identify each record in the Paradox table. Thus, no two records in a Paradox table can share the same values in their primary key fields. Once a primary index is created for a Paradox table, the table's records are re-ordered based on the primary key fields. At the time a primary index is created, if any records have matching primary key field values, Paradox deletes all but the first record. Paradox creates this index as maintained; that is, if you modify, add, or delete records in the table, the primary index is updated automatically to reflect these changes.

A primary index is a single file with the same name as the table on which it is based but with a .PX extension.

To lock records, you must have a primary index.

Non-Primary Index

Paradox 7, 8, and 9 tables support UNIQUE secondary indexes. Refer to "Create and Drop Index Statements" on page 214 for more information.

A non-primary index is defined by specifying one or more fields in the Paradox table that constitute the non-primary key field. It allows Paradox to sort each record in the table according to the values of the non-primary key fields.

There are two kinds of non-primary indexes: maintained and non-maintained. A maintained index is automatically updated when the table is changed, whereas a non-maintained index is not. Instead, a non-maintained index is tagged out-of-date and is updated when the index is used again.

You must have a primary index on a table before you create a maintained, non-primary index.

The Paradox driver uses non-maintained indexes only for read-only queries on locked tables. A primary index is not required for the non-maintained index to be used.

For Paradox 3.*x*, a single non-primary index consists of a pair of files with the same name as the table on which the non-primary index is based; one of these files has an .X*nn* extension while the other has a .Y*nn* extension (where the hexadecimal number *nn* corresponds to the field number of the non-primary key field for the non-primary index).

For Paradox 4.*x*, 5, 7, 8, and 9 single-field non-primary indexes that are case-sensitive have the same name as their associated table and are assigned file extensions .X01 through .XFF, depending on the number of the field on which the index is based. Single-field non-primary indexes that are case insensitive and composite indexes have the same name as the table on which they are based. They are assigned file extensions sequentially starting with .XG0 (with hexadecimal increments).

Create and Drop Index Statements

The Paradox driver supports SQL statements to create and delete indexes. The Create Index Primary statement is used to create primary indexes. The Create Index statement is used to create non-primary indexes. The Drop Index statement is used to delete indexes.

Create Index Primary Statement

The syntax for creating a primary index is:

```
CREATE [UNIQUE] INDEX PRIMARY ON
table_name (column [,column...])
```

The UNIQUE keyword is optional; the index is unique whether or not you include this keyword.

table_name is the name of the table on which the index is to be based.

column is the name of a column that is included as the key field for the index. The column list must contain one or more consecutive fields in the table, beginning with the first field in the table.

For example:

```
CREATE UNIQUE INDEX PRIMARY ON emp (emp_id)
```

Be careful when you create a primary key because any rows that have a primary key duplication are deleted when you execute the Create Index Primary statement.

Create Index Statement

For Paradox 3.0, 3.5, 4.0, 4.5, and 5.0 tables, the syntax for creating a non-primary index is:

```
CREATE INDEX index_name
[/NON_MAINTAINED] [/CASE_INSENSITIVE] ON
table_name (column [, column...])
```

For Paradox 7, 8, and 9 tables, the syntax for creating a non-primary index is:

```
CREATE [UNIQUE] INDEX index_name
[/NON_MAINTAINED] [/CASE_INSENSITIVE] ON
table_name [column [DESC] [,column...]
```

For Paradox 7, 8, and 9 tables only (when the Create Type is 7, 8, or 9), the optional UNIQUE keyword prevents duplicate values in the non-primary index.

index_name identifies the index. If the name contains blanks or special characters, or does not begin with a letter, surround it with the grave character (`) (ASCII 96).

The NON_MAINTAINED switch makes the index non-maintained. The default is to create a maintained index.

The CASE_INSENSITIVE switch makes the index case-insensitive. The default is to create a case-sensitive index.

table_name is the name of the table on which the index is to be based.

column is the name of a column that is included as a the key field for the index.

For Paradox 7, 8, or 9 tables only (when the Create Type is 7, 8, or 9), the DESC keyword creates a non-primary index that uses descending keys.

Paradox 3.0 and 3.5 tables cannot have composite or case-insensitive indexes. When you create a non-primary index for Paradox 3.0 and 3.5 tables, follow these rules:

- Specify only one column name.
- Do not use the CASE_INSENSITIVE switch.
- Use the column name as the index name.

For example:

```
CREATE INDEX last_name ON emp (last_name)
```

Drop Index Statement

The syntax for dropping a primary index is

DROP INDEX *path_name*.PRIMARY

For example:

```
DROP INDEX emp.PRIMARY
```

The syntax for dropping a non-primary index is

DROP INDEX *path_name*.*index_name*

path_name is the name of the table from which the index is being dropped. The pathname can be either the fully qualified pathname or, if the table is specified with the Database attribute of the connection string, a simple table name.

index_name is the name that was given to the index when it was created. If the name contains blanks or special characters, or does not begin with a letter, surround it with the grave character (`) (ASCII 96). Use the column name as the index name when dropping indexes from Paradox 3.5 or 3.0 tables.

For example:

```
DROP INDEX emp.last_name
```

Transactions

The Paradox driver supports transactions. A transaction is a series of database changes that is treated as a single unit. In applications that don't use transactions, the Paradox driver immediately executes Insert, Update, and Delete statements on the database tables and the changes are automatically committed when the SQL statement is executed. There is no way to undo such changes. In applications that use transactions, inserts, updates, and deletes are held until a Commit or Rollback is specified. A Commit saves the changes to the database file; a Rollback discards the changes.

Transactions affect the removal of record locking. All locks are removed when SQLTransact is called with the Commit or Rollback option to end the active transaction.

Isolation and Lock Levels Supported

Paradox supports isolation levels 1 (read committed) and 3, (serializable). It supports record- and table-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Paradox driver. In addition, the following functions are supported:

- SQLSetPos
- SQLPrimaryKeys

When used with Paradox 5 or Paradox 7, 8, and 9 tables, the Paradox driver supports the SQLForeignKeys function. The Paradox driver also supports backward and random fetching in SQLExtendedFetch and SQLFetchScroll. The Paradox driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The Paradox database system supports multiple connections and multiple statements per connection.

10 Connect ODBC for PROGRESS

Connect ODBC for PROGRESS (the "PROGRESS driver") supports database version 7.3 and version 8.*x* of the PROGRESS database system in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the PROGRESS driver.

System Requirements

To access a PROGRESS database with a PROGRESS driver, your system must include the following items.

On the client computer: PROGRESS Version 8.2A installation of Client Networking for Windows NT.

On the Server computer:

- PROGRESS Version 7.3C (or later) Server Networking and Database Server installed on the platform you choose as your database server machine.
- PROGRESS Version 7.3C (or later) Client Networking installed on the platform you choose for your OID, if you choose to connect via server rather than directly.

Note: The PROGRESS driver accesses PROGRESS databases that are created with Version 7.3C or later. This driver cannot access Version 6 PROGRESS databases.

Before using the driver, you must set the IDLC environment variable to your PROGRESS DLC directory. For example:

```
set IDLC=C:\DLC
```

Configuring Data Sources

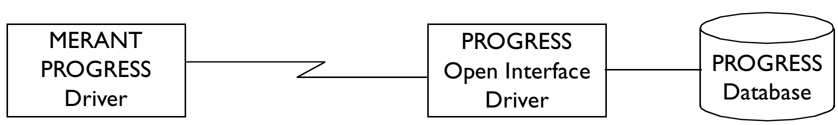
The DataDirect ODBC PROGRESS driver supports the following data source configurations:

- Remote OID with direct database access
- Remote OID with database access via server

The PROGRESS driver does not support remote, single-user configurations.

Remote OID with Direct Access

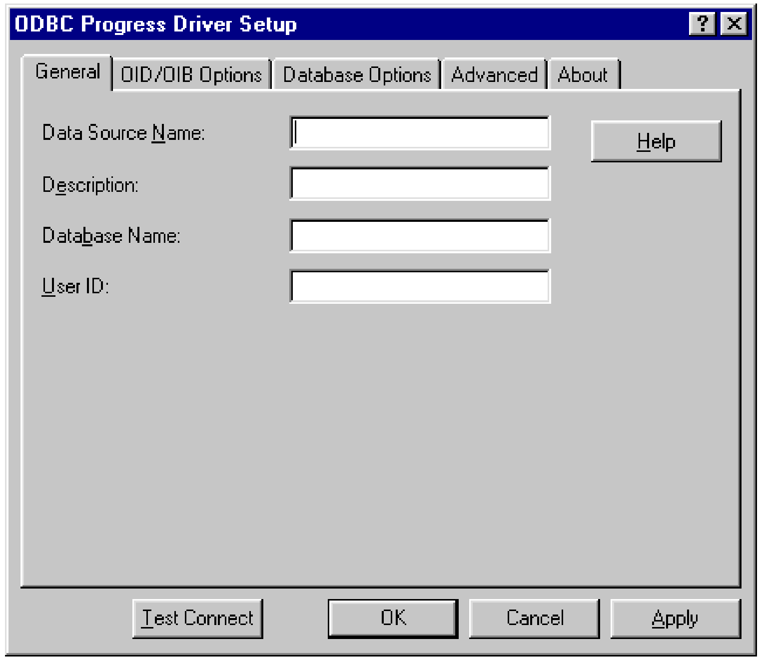
The following figure shows a Direct Access configuration.



To configure a PROGRESS data source for a remote OID with direct database access (no server process) configuration:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC PROGRESS Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the PROGRESS driver and click **Finish** to display the ODBC PROGRESS Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 234 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply.**

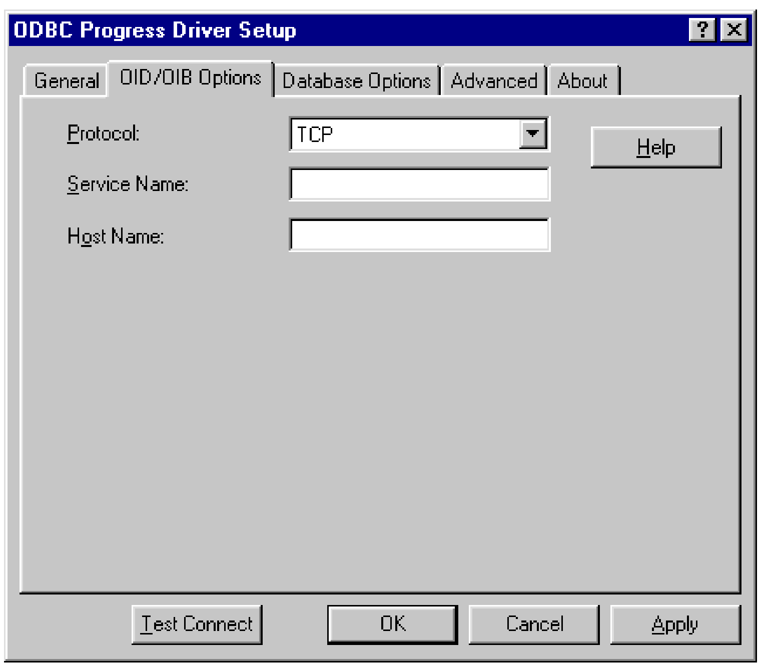
Data Source Name: Identifies this PROGRESS data source configuration in the system information. Examples include "Accounting" or "PROG-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "PROGRESS on Server number 1."

Database Name: The name of the database to which you want to connect by default.

User ID: The default logon ID used to connect to your PROGRESS database. Your ODBC application may override this value or you may override this value in the Logon dialog box or connection string.

5 Click the **OID/OIB Options** tab to specify OID options.



6 Specify values for the following; then, click **Apply.**

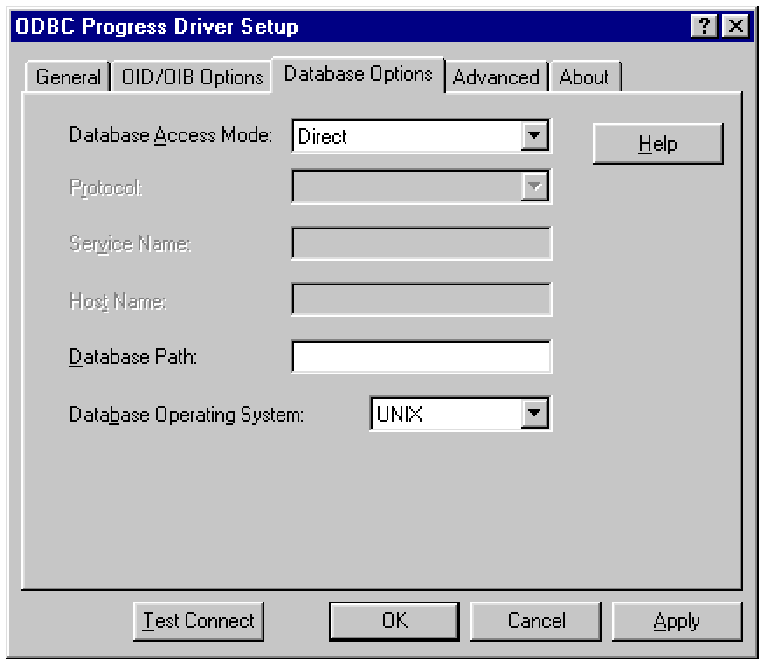
Protocol: TCP, NETBIOS, or SPX.

Service Name: Specify the service name of the OID as listed in the services file.

Host Name: Specify the host name of the OID/OIB machine.

An Open Interface Broker or Open Interface Driver must be running on the specified host to connect to the database.

7 Click the **Database Options** tab to specify database options.



8 Specify values for the following; then, click **Apply.**

Database Access Mode: Select Direct.

Protocol: Not applicable for this configuration.

Service Name: Not applicable for this configuration.

Host Name: Not applicable for this configuration.

Database Path: The fully qualified directory path on the server containing the database (not including the database name or extension).

Database Operating System: Select the type of server that the database resides on.

If you select Ignore, you must type a qualified separator as the last character in the Database Path field describe above.

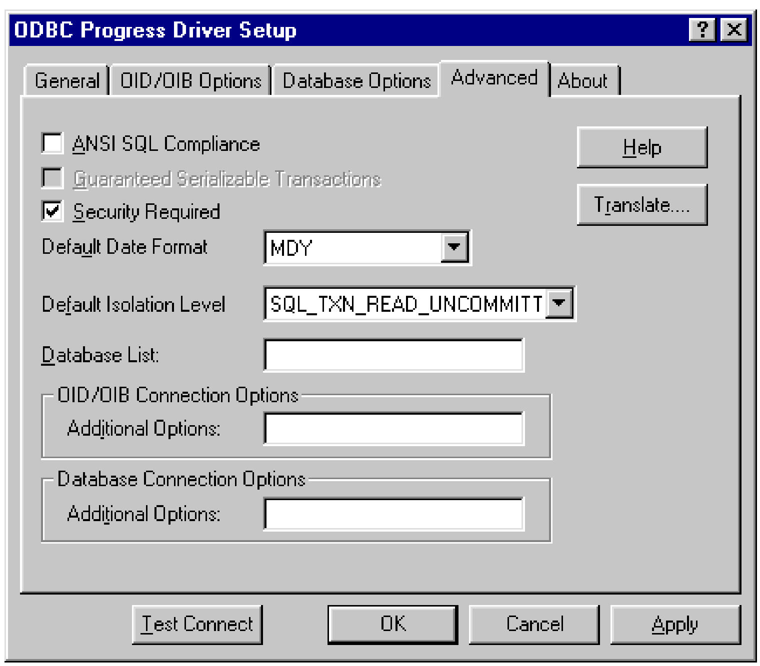
For example, for Windows NT:

```
c:\progress\
```

and for UNIX:

```
/databases/progress/
```

9 Click the **Advanced** tab to specify optional data source settings.



10 Specify values for the following; then, click **Apply.**

ANSI SQL Compliance: Allows case-sensitive character data.

Guaranteed Serializable Transactions: Allows serializable transactions. To select this option, the ANSI SQL Compliance check box must be selected.

Security Required: Determines whether the logon ID (UID) is required in the connection string.

Default Date Format: Specifies whether PROGRESS uses MDY, DMY, or YMD as the default date format.

Default Isolation Level: Specifies the default isolation level for concurrent transactions. SQL_TXN_READ_COMMITTED and SQL_TXN_READ_UNCOMMITTED are the values. You should select SQL_TXN_READ_UNCOMMITTED to work around specific locking problems.

Database List: Specify a comma-delimited list of up to four databases to which the driver will connect in addition to the default database. The default database must not be part of this list. The same User I.D., password and path as the default database must be applicable to these databases. In a session, users can access only the default database and those databases specified in this list.

OID/OIB Connection Options/Additional Options: Specify additional PROGRESS parameters for Open Interface Driver/Open Interface Broker installation. The format for specifying these options is:

`-`*`syntax parameter_definition…`*

For more information about these parameters, refer to the system administration documentation for PROGRESS.

Database Connection Options/Additional Options: Specify additional PROGRESS parameters for the database connection. The format for specifying these options is:

`-`*`syntax parameter_definition`*…

For more information about these parameters, refer to the system administration documentation for PROGRESS.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

11 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Local Access on a Windows 9x or Windows NT System

Local access on a Windows 9*x* or Windows NT system can be accomplished by using Remote OID (located on the client) and Direct Access mode (to a database located on the client). Both OID and the database server must be started on the client from the directory containing the database.

Do the following:

1 Set the environment:

```
SET IDLC=C:\DLC82
SET DLC=C:\DLC82
SET PROOIBRK=%DLC%\BIN\oibrkr32.exe
SET PROOIDRV=%DLC%\BIN\oidrvr32.exe
SET PATH=%PATH%;%DLC%;%DLC%\BIN
```

where C:\DLC82 is the directory to which PROGRESS was installed.

2 You must start Open Interface Broker in the directory containing the database to ensure a proper self-serving OID client:

```
%DLC%\BIN\oibrkr32.exe -SV -S pdro82oid
```

where "pdro82oid" is the service name as specified in the SERVICES file.

3 Start the database server:

```
%DLC%\BIN\_mprosrv test
```

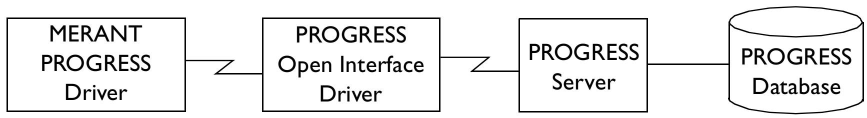
where "test" is the database name.

4 The following is sample connection information:

```
Database=test
UID=<blank>
PWD=<blank>
OID/OIB Protocol=TCP
OID/OIB Service Name=pdro82oid
OID/OIB Host Name=localhost
Database Access Mode=Direct
Database Path=c:\protmp82
Database Operating System=Windows
```

Remote OID with Database Access via Server

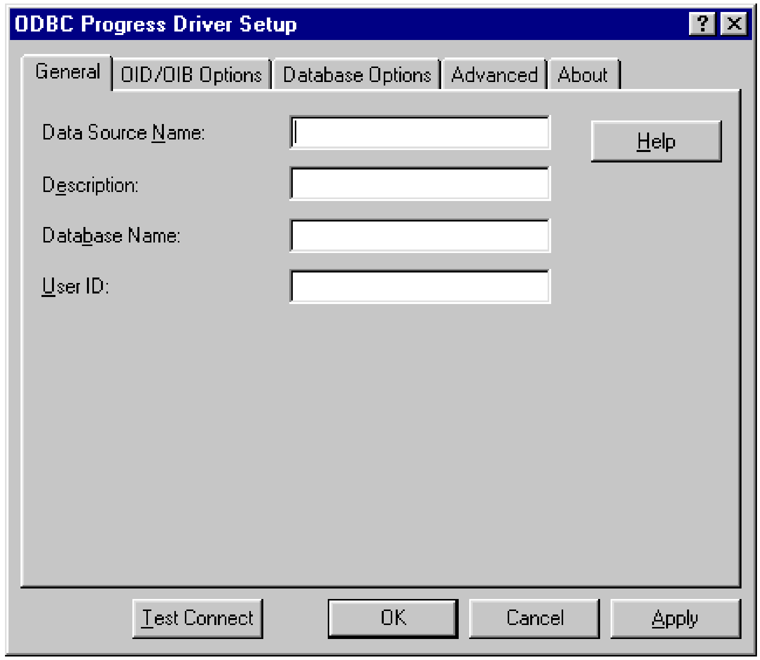
The following figure shows a database access via server configuration.



To configure a PROGRESS data source for a remote OID with database access via a server:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC PROGRESS Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the PROGRESS driver and click **Finish** to display the ODBC PROGRESS Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 234 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that the all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply.**

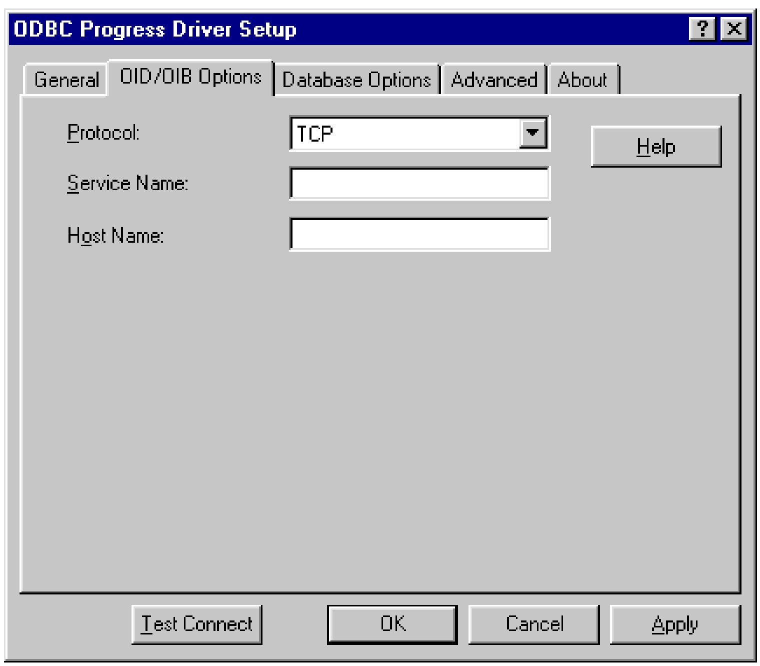
Data Source Name: Identifies this PROGRESS data source configuration in the system information. Examples include "Accounting" or "PROG-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "PROGRESS on Server number 1."

Database Name: The name of the database to which you want to connect by default.

User ID: The default logon ID used to connect to your PROGRESS database. Your ODBC application may override this value or you may override this value in the Logon dialog box or connection string.

5 Click the **OID/OIB Options** tab to specify OID options.



6 Specify values for the following; then, click **Apply.**

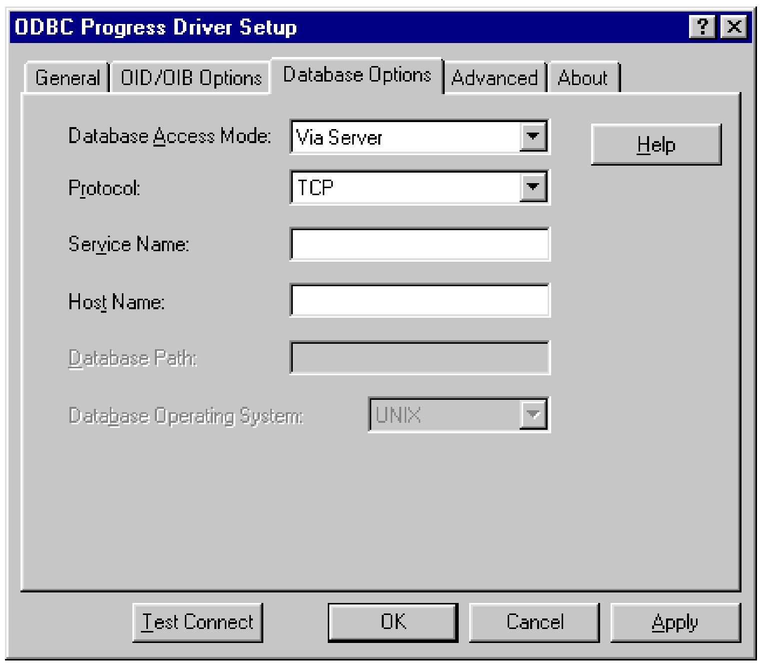
Protocol: TCP, NETBIOS, or SPX.

Service Name: Specify the service name of the OID as listed in the services file.

Host Name: Specify the host name of the OID/OIB machine.

An Open Interface Broker or Open Interface Driver must be running on the specified host to connect to the database.

7 Click the **Database Options** tab to specify database options.



8 Specify values for the following; then, click **Apply.**

Database Access Mode: Select Via Server.

Protocol: Select the type of protocol your configuration uses: NETBIOS, SPX, or TCP.

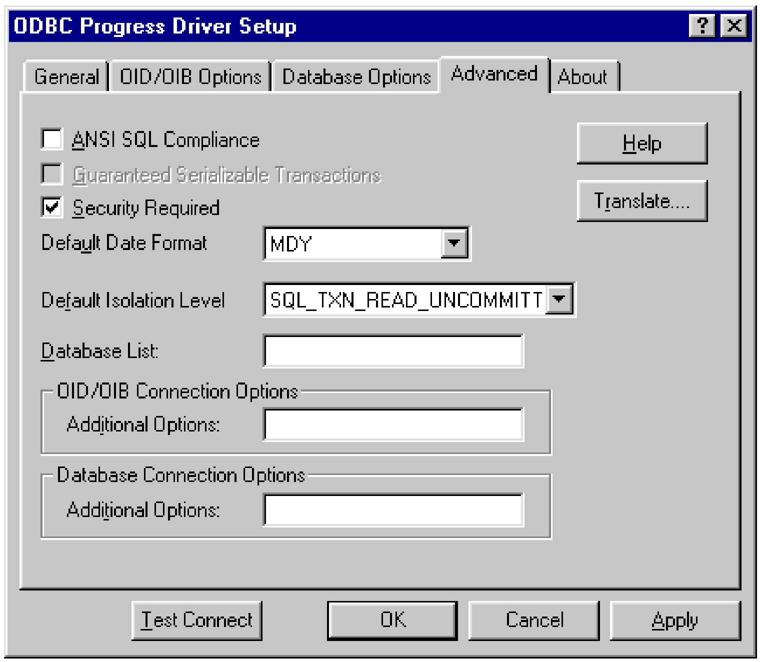
Service Name: Specify the service name of the server process machine.

Host Name: Specify the host name of the server process machine.

Database Path: Not applicable for this configuration.

Database Operating System: Not applicable for this configuration.

9 Click the **Advanced** tab to specify optional data source settings.



10 Specify values for the following; then, click **Apply.**

ANSI SQL Compliance: Allows case-sensitive character data.

Guaranteed Serializable Transactions: Allows serializable transactions. To select this option, the ANSI SQL Compliance check box must be selected.

Security Required: Determines whether the logon ID (UID) is required in the connection string.

Default Date Format: Specifies whether PROGRESS uses MDY, DMY, or YMD as the default date format.

Default Isolation Level: Specifies the default isolation level for concurrent transactions. SQL_TXN_READ_COMMITTED and SQL_TXN_READ_UNCOMMITTED are the values. You should select SQL_TXN_READ_UNCOMMITTED to work around specific locking problems.

Database List: Not applicable for this configuration.

OID/OIB Connection Options/Additional Options: Specify additional PROGRESS parameters for Open Interface Driver/Open Interface Broker installation. The format for specifying these options is:

```
-syntax parameter_definition…
```

For more information about these parameters, refer to the system administration documentation for PROGRESS.

Database Connection Options/Additional Options: Specify additional PROGRESS parameters for the database connection. The format for specifying these options is:

```
-syntax parameter_definition…
```

For more information about these parameters, refer to the system administration documentation for PROGRESS.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

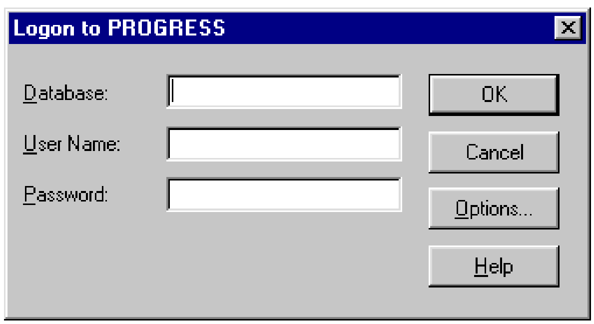
Select a translator; then, click **OK** to close this dialog box and perform the translation.

11 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this

procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For PROGRESS, the dialog box is as follows:

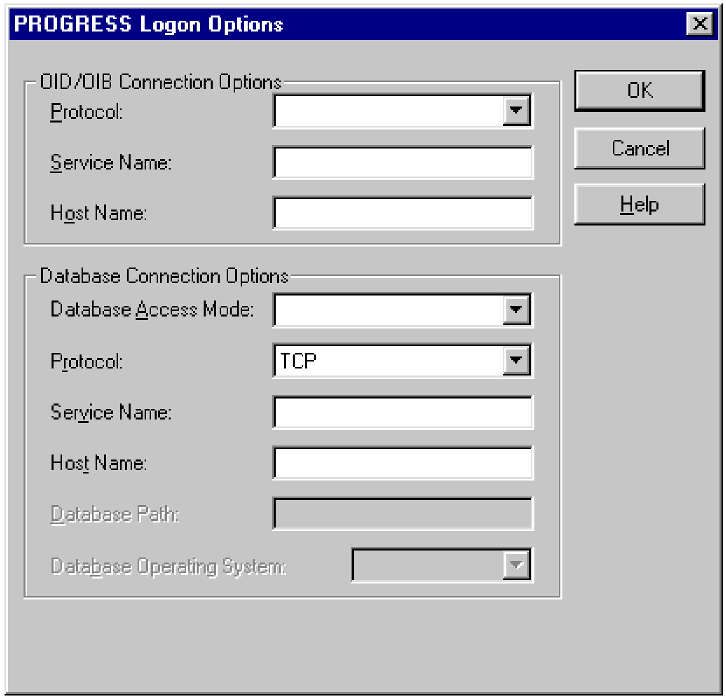


In this dialog box, do the following:

1. Type the name of the database to which you want to connect (without a path or an extension).
2. If required, type your user name.
3. If required, type your password.

   User name and password are optional parameters. You can log on to the database without these parameters, but you may not be able to create, delete, or manipulate the data.

4 Click **Options** to display the PROGRESS Logon Options dialog box.



5 Specify values for the following; then, click **OK** to complete the logon and to update the values in the system information:

Protocol: Specifies the protocol used for communication with the OID; TCP, NETBIOS, or SPX.

Service Name: Specifies the service name of the OID as listed in the services file.

Host Name: Specifies the host name of the OID/OIB machine.

An Open Interface Broker or Open Interface Driver must be running on the specified host to connect to the database.

Database Access Mode: Specifies how the OID accesses the database. Select Direct if the OID access the database file directly. Select Via Server if the OID accesses the database through a server process.

Protocol: Specifies the type of protocol your configuration uses: NETBIOS, SPX, or TCP. This option is available only when the Database Access option is set to Via Server.

Service Name: For Via Server configurations, specifies the service name of the server process. Not applicable for Direct configurations.

Host Name: For Via Server configurations, specifies the host name of the server process machine. Not applicable for Direct configurations.

Database Path: Specifies the path name of the database when the OID accesses the database directly (not via a server). This setting is necessary only when the Database Connection Options/Database Access option is set to Direct.

Database Operating System: Specifies the operating system the database is stored under. The system uses the specified operating system to determine which qualifier separator to use when building the database path: backslash (\) for Windows or slash (/) for UNIX. This setting is necessary only if the Database Connection Options/Database Access is set to Direct.

Note: If you select Ignore, you must type a qualifier separator as the last character in the Database Path field described above. For example, for Windows NT:

```
c:\progress\
```

and for UNIX:

```
/databases/progress/
```

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]"
```

An example of a connection string for PROGRESS is:

```
DSN=PROGRESS;DB=PAYROLL;UID=JOHN;PWD=XYZZY;
OIDP=TCP;OIDS=PRO81OID;OIDH=PROSRV1;
DBAM=VIASERVER;DBPR=TCP;DBS=PRO81SRVPAYROLL;
DBH=PROSRV1;ASC=0
```

Table 10-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 10-1. PROGRESS Connection String Attributes

Attribute	Description
ANSISQL Compliance (ASC)	ANSISQLCompliance={0 | 1}. This attribute determines whether the values in a character column, and comparisons made to them, must be case-sensitive. The default is 0; that is, not case-sensitive.
Database (DB)	The name of the database to which you want to connect.
DatabaseOS (DBOS)	DatabaseOS={Windows | Unix | Ignore | VMS}. This attribute specifies the type of path separator (forward slash or backward slash) to used when building the database path.
DataSourceName (DSN)	A string that identifies a PROGRESS data source configuration in the system information. Examples include "Accounting" or "PROG-Serv1."
DBAccessMode (DBAM)	DBAccessMode={Direct | Via Server}. Specifies how the OID accesses the database. Select Direct if the OID accesses the database file directly. Select Via Server if the OID accesses the database through a server process.
DBHost (DBH)	If DBAccessMode=Via Server, specify the host name of the server machine.
DBOptions (DBO)	A string containing parameters to be used when the OID connects to the specified database(s). The format for specifying OID connections options is: `ODBOptions=-`*`syntax parameter_definition`*`. . .`
DBPath (DBPA)	If DBAccessMode (DBAM) is Via Server, the path name of the database (without the database name).
DBProtocol (DBPR)	DBProtocol={NETBIOS | SPX | TCP}. If DBAccessMode=Via Server, specify the protocol to connect the Open Interface Driver (OID) to the PROGRESS database server.
DBService (DBS)	If DBAccessMode=Via Server, specify the service name of the server machine.

Table 10-1. PROGRESS Connection String Attributes *(cont.)*

DefaultDate Format (DDF)	DefaultDateFormat={MDY | DMY | YMD}. Specifies whether PROGRESS uses MDY, DMY, or YMD as the default date format.
DefaultIsolation Level (DIL)	DefaultIsolationLevel={0 | 1}. Specifies the default isolation level for concurrent transactions. The values are SQL_TXN_READ_COMMITTED (0) and SQL_TXN_READ_UNCOMMITTED (1). The default is SQL_TXN_READ_UNCOMMITTED. You should select SQL_TXN_READ_UNCOMMITTED to work around specific locking problems.
GSTransaction (GST)	GSTransaction={0 | 1}. Set this attribute to 1 to allow serializable transactions. This attribute can be set to 1 only if the ANSISQLComplicance attribute is set to 1. The initial default is 0.
LogonID (UID)	The default logon ID (user name) used to connect to your PROGRESS database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID. This ID is case-sensitive.
OIDHost (OIDH)	The host name of the Open Interface Driver (OID). (If the OID is local, enter the local machine's host name in this field). An Open Interface Broker or Open Interface Driver must be running on the specified host to connect to the database.
OIDOptions (OIDO)	A string containing parameters to be passed to the OID when it is auto-started. The format for specifying OID connection options is: `OIDOptions=-`*`syntax parameter_definition`*`. . .`
OIDProtocol (OIDP)	OIDProtocol={TCP | NETBIOS | SPX}. The protocol to connect the PROGRESS driver to the Open Interface Driver (OID).
OIDService (OIDS)	The service name of the Open Interface Driver (OID).

Table 10-1. PROGRESS Connection String Attributes (cont.)

Password (PWD)	A case-sensitive password.
SecurityRequired (SR)	SecurityRequired={0 | 1}. Determines whether the logon ID (UID) is required in the connection string. The default is 1, which is Security Required.

Data Types

Table 10-2 shows how the PROGRESS data types are mapped to the standard ODBC data types.

Table 10-2. PROGRESS Data Types

PROGRESS	ODBC
Character	SQL_VARCHAR
Date	SQL_TYPE_DATE
Decimal	SQL_DECIMAL
Float	SQL_FLOAT
Integer	SQL_INTEGER
Logical	SQL_BIT

Isolation and Lock Levels Supported

PROGRESS supports isolation level 1 (read committed) if the data source was defined without Guaranteed Serializable Transactions; otherwise, PROGRESS supports isolation level 3 (serializable). PROGRESS supports record-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the functions supported by the PROGRESS driver. The driver supports the core SQL grammar.

The driver also supports the function SQLSetPos and forward and backward scrolling with SQLExtendedFetch and SQLFetchScroll.

Connections and Statements Supported

The PROGRESS database system supports multiple connections and multiple statements per connection.

11 Connect ODBC for SQL Server

Connect ODBC for SQL Server (the "SQL Server driver") supports the SQL Server database system versions 6.5 and 7.0 available from Microsoft in the Windows 9*x*, Windows NT, and UNIX environments.

See the README file shipped with your DataDirect product for the file name of the SQL Server driver.

System Requirements

The following sections provide system requirement information for both Windows and UNIX platforms.

Windows 9*x* and Windows NT

You must have the appropriate network software. The driver communicates with network software through the SQL Server Net-Library interface, which requires a Net-Library dynamic-link library (DLL). The SQL Server version 7.0 ODBC driver requires the SQL Server 7.0 versions of Net-Library DLL files. These are installed when you run the driver Setup.

The SQL Server driver requires Microsoft client software; it does *not* work with Sybase System 10 or 11 software.

UNIX

To use the SQL Server driver on UNIX, you must have TCP/IP configured on both the UNIX client and the Windows NT server on which the SQL Server database resides. The UNIX SQL Server TCP/IP network client library is built into the UNIX SQL Server ODBC driver. Nothing else is required beyond the normal ODBC environment.

The SQL Server Client configuration has been merged with the ODBC driver configuration and is set in the system information file.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

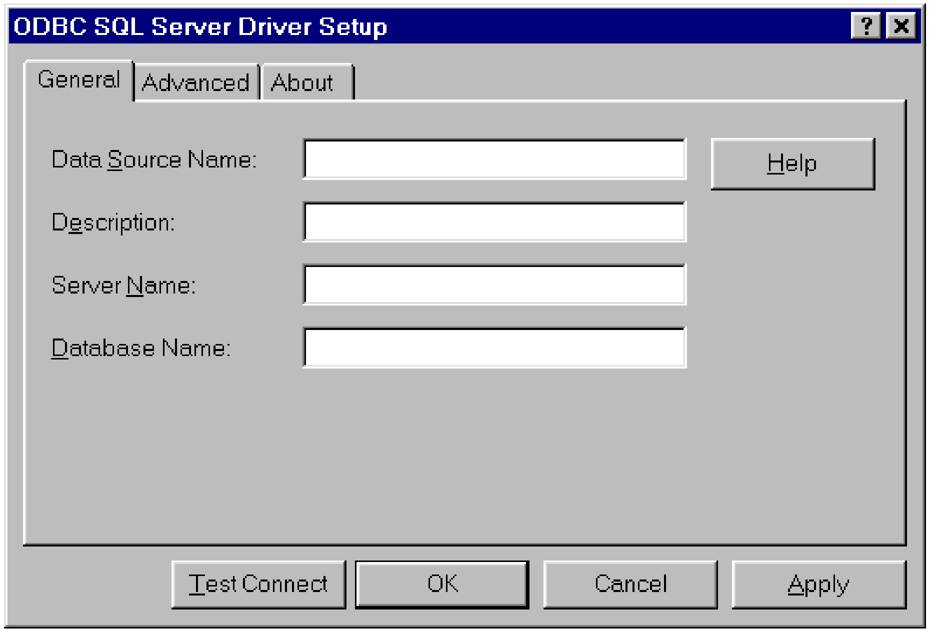
In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 11-2. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure an SQL Server data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring a new data source, click **Add**. A list of installed drivers appears. Select SQL Server and click **Finish** to display the ODBC SQL Server Driver Setup dialog box.

   If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC SQL Server Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 248 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply.**

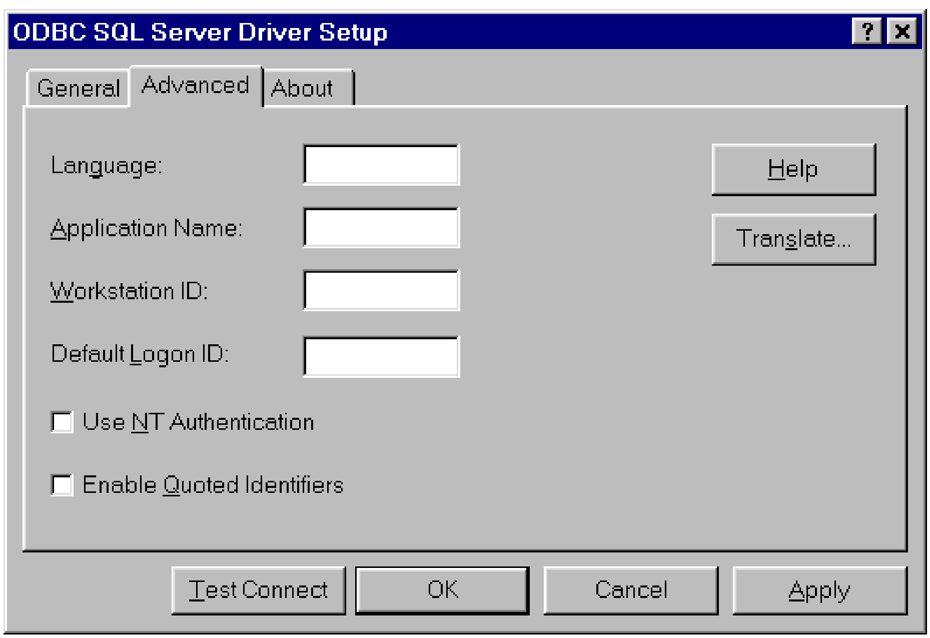
Data Source Name: A string that identifies this SQL Server data source configuration in the system information. Examples include "Accounting" or "SQL Server-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "SQL Server on Server number 1."

Server Name: The name of the server that contains the database you want.

Database Name: The name of the database to which you want to connect by default. If you do not specify a value, the default database defined by SQL Server is used.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Language: The national language to be used by the client. The default is English.

Application Name: The name SQL Server uses to identify your application.

Workstation ID: The workstation ID used by the client.

Default Logon ID: The default logon ID used to connect to your SQL Server database. This ID is case-sensitive. A logon ID is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in the Logon dialog box or connection string.

Use NT Authentication: Enables Windows NT security. When enabled, the Default Logon ID field is inactive because Windows NT security passes the logon ID and password. Activating this check box also activates the corresponding check box on the Logon Dialog.

Enable Quoted Identifiers: Enables quoted identifiers; that is, identifiers in SQL Server can be quoted using a quoting character. The default is not selected.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override

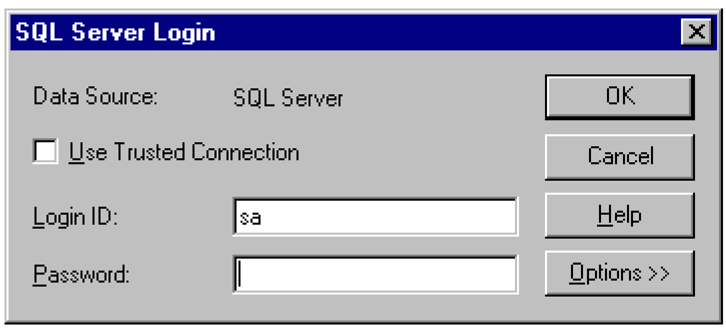
these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a Logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified.

The SQL Server driver displays the SQL Server Login dialog box when you call an ODBC connection without specifying enough information for the driver to connect to an SQL Server.

In this dialog box, do the following:



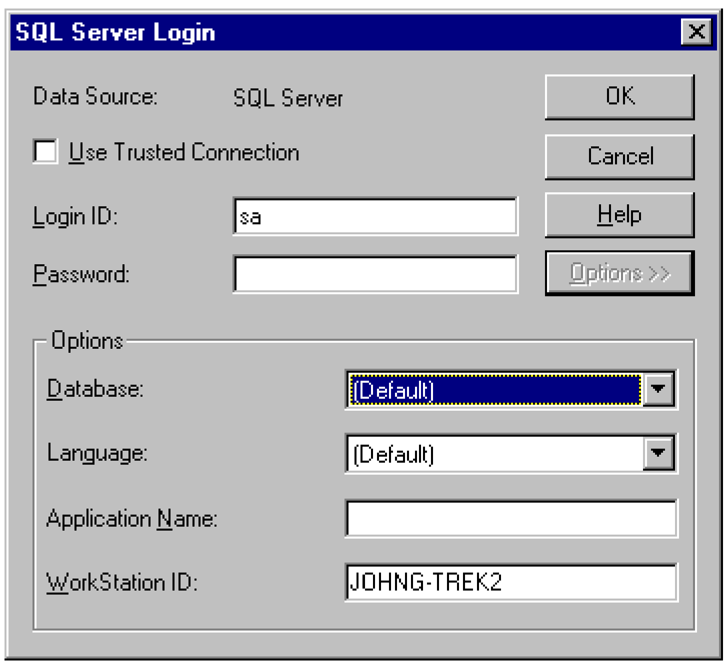
1 Select the Use Trusted Connection check box to specify that the SQL Server driver request a secure (or trusted) connection to an SQL Server running on Windows NT. SQL Server uses integrated login security to establish connections using this data source, regardless of the current login security mode at the server. Any login ID or password supplied is ignored. The SQL Server system administrator must have associated your Windows network ID with an SQL Server login ID.

Clear this box to specify that SQL Server use standard login security to establish connections using this data source. You must specify a login ID and password for all connection requests.

2 Type the SQL Server login ID to use for the connection if Use Trusted Connection is not selected. If Use Trusted Connection is selected, the Login ID box is disabled.

3 Type the password to use for the connection if Use Trusted Connection is not selected. If Use Trusted Connection is selected, the Password box is disabled.

4 You can click **Options** to display the SQL Server Logon Options pane and specify the initial SQL Server database to which to connect.



Database: Specifies the default database to use on the connection. This overrides the default database specified for the login on the server. If no database is specified, the connection uses the default database specified for the login on the server.

Language: Specifies the national language to use for SQL Server system messages. The SQL Server must have the language installed. This overrides the default language specified for the login on the server. If no language is specified, the connection uses the default language specified for the login on the server.

Application Name: Optionally, you can specify the application name to be stored in the program_name column in the row for this connection in master.dbo.sysprocesses.

Workstation I.D.: Optionally, you can specify the workstation ID to be stored in the hostname column in the row for this connection in master.dbo.sysprocesses.

5 Click **OK** to log on to the SQL Server database installed on the server you specified and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for SQL Server is:

```
DSN=Accounting;UID=JOHN;PWD=XYZZY
```

The following tables give the names and descriptions of the attributes.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Windows

Table 11-1. Connection String Attributes on Windows

Attribute	**Description**
Address	Network address of the server running SQL Server. Used only if the Server keyword does not specify the network name of a server running SQL Server. Address is usually the network name of the server, but can be other names such as a pipe, or a TCP/IP port and socket address. For example, on TCP/IP: 199.199.199.5, 1433 or MYSVR, 1433.
AnsiNPW	AnsiNPW={yes | no}. When yes, the driver uses ANSI-defined behaviors for handling NULL comparisons, character data padding, warnings, and NULL concatenation. When no, ANSI defined behaviors are not exposed.

***Table 11-1. Connection String Attributes on Windows** (cont.)*

Attribute	Description
APP	Name of the application calling SQLDriverConnect (optional). If specified, this value is stored in the master.dbo.sysprocesses column program_name and is returned by sp_who and the Transact-SQL APP_NAME function.
AttachDBFileName	Name of the primary file of an attachable database. Include the full path and escape any slash (\ ) characters if using a C character string variable: AttachDBFileName=c:\\MyFolder\\MyDB.mdf This database is attached and becomes the default database for the connection. To use AttachDBFileName you must also specify the database name in either the SQLDriverConnnect DATABASE parameter or the SQL_COPT_CURRENT_CATALOG connection attribute. If the database was previously attached, SQL Server will not reattach it; it will use the attached database as the default for the connection.
AutoTranslate	AutoTranslate={yes | no}. When *yes*, ANSI character strings sent between the client and server are translated by converting through Unicode to minimize problems in matching extended characters between the code pages on the client and the server. These conversions are performed on the client by the SQL Server ODBC driver. This requires that the same ANSI code page (ACP) used on the server be available on the client.

***Table 11-1. Connection String Attributes on Windows** (cont.)*

Attribute	Description
AutoTranslate (*cont.*)	These settings have no effect on the conversions that occur for these transfers: Unicode SQL_C_WCHAR client data sent to char, varchar, or text on the server. Char, varchar, or text server data sent to a Unicode SQL_C_WCHAR variable on the client. ANSI SQL_C_CHAR client data sent to Unicode nchar, nvarchar, or ntext on the server. Unicode char, varchar, or text server data sent to an ANSI SQL_C_CHAR variable on the client. When *no*, character translation is not performed. The SQL Server ODBC driver does not translate client ANSI character SQL_C_CHAR data sent to char, varchar, or text variables, parameters, or columns on the server. No translation is performed on char, varchar, or text data sent from the server to SQL_C_CHAR variables on the client. If the client and SQL Server are using different ACPs, then extended characters can be misinterpreted.
DATABASE	Name of the default SQL Server database for the connection. If Database is not specified, the default database defined for the login is used. The default database from the ODBC data source overrides the default database defined for the login. The database must be an existing database unless AttachDBFileName is also specified. If AttachDBFileName is specified, the primary file it points to is attached and given the database name specified by DATABASE.

Table 11-1. Connection String Attributes on Windows *(cont.)*

Attribute	Description
Fallback *SQL Server 6.5 only*	Fallback={yes | no}. When yes, instructs the driver to attempt connection to a fallback server if connection to a primary server fails. The login time-out (set with ODBC SQLSetConnectAttr, attribute SQL_ATTR_LOGIN_TIMEOUT) must be set for fallback to occur. When no, no attempt at a fallback connection is made. This option applies only to standby servers. It does not apply to a virtual server in a cluster/failover configuration.
LANGUAGE	SQL Server language name (optional). SQL Server can store messages for multiple languages in sysmessages. If connecting to a SQL Server with multiple languages, Language specifies which set of messages are used for the connection.
Network	Name of a network library dynamic-link library. The name need not include the path and must not include the .dll file name extension, for example, Network=dbnmpntw.
PWD	The password for the SQL Server login account specified in the UID parameter. PWD need not be specified if the login has a NULL password or when using Windows NT authentication (Trusted_Connection = yes).
SAVEFILE	Name of an ODBC data source file into which the attributes of the current connection are saved if the connection is successful.
SERVER	Name of a server running SQL Server on the network. The value must be either the name of a server on the network, or the name of an SQL Server Client Network Utility advanced server entry. You can enter "(local)" as the server name on Windows NT to connect to a copy of SQL Server running on the same computer.

Table 11-1. Connection String Attributes on Windows *(cont.)*

Attribute	Description
QueryLogFile	Full path and file name of a file to be used for logging data about long-running queries.
QueryLog_On	QueryLog_On={yes | no}. When yes, logging long-running query data is enabled on the connection. When no, long-running query data is not logged.
QueryLogTime	Digit character string specifying the threshold (in milliseconds) for logging long-running queries. Any query that does not receive a response in the time specified is written to the long-running query log file.
QuotedID	QuotedID={yes | no}. When yes, QUOTED_IDENTIFIERS is set ON for the connection, and SQL Server uses the SQL-92 rules regarding the use of quotation marks in SQL statements. When no, QUOTED_IDENTIFIERS is set OFF for the connection, and SQL Server follows the legacy Transact-SQL rules regarding the use of quotation marks in SQL statements.
Regional	Regional={yes | no}. When yes, the SQL Server driver uses client settings when converting currency, date, and time data to character data. The conversion is one way only; the driver does not recognize non-ODBC standard formats for date strings or currency values. When no, the driver uses ODBC standard strings to represent currency, date, and time data that is converted to string data.
StatsLogFile	Full path and file name of a file used to record SQL Server driver performance statistics.
StatsLog_On	StatsLog_On={yes | no}. When yes, enables the capture of SQL Server driver performance data. When no, SQL Server driver performance data is not available on the connection.

Table 11-1. Connection String Attributes on Windows (cont.)

Attribute	Description
Trusted_Connection	Trusted_Connection={yes | no}. When yes, instructs the SQL Server driver to use Windows NT Authentication Mode for login validation. The UID and PWD keywords are optional. When no, instructs the SQL Server driver to use a SQL Server username and password for login validation. The UID and PWD keywords must be specified
UID	A valid SQL Server login account. UID need not be specified when using Windows NT authentication.
UseProcForPrepare *SQL Server 6.5 and earlier only*	UseProcForPrepare={0 | 1 | 2}. When 0, the SQL Server ODBC driver does not create temporary stored procedures for SQLPrepare. When 1, instructs the SQL Server ODBC driver to create temporary stored procedures when statements are prepared with SQLPrepare. The temporary stored procedures are not dropped until the connection is broken. When 2, the SQL Server ODBC driver creates temporary stored procedures for SQLPrepare, but only one procedure is created per statement handle and the procedure is dropped when the statement handle becomes invalid or a new SQL statement is prepared.
WSID	Workstation ID. Typically, this is the network name of the computer on which the application resides (optional). If specified, this value is stored in the master.dbo.sysprocesses column hostname and is returned by sp_who and the Transact-SQL HOST_NAME function.

UNIX

UNIX

Table 11-2. Connection String Attributes on UNIX

Attribute	Description
Address	Network address of the server running SQL Server. This is required on UNIX and must be a TCP/IP port and socket address, for example, 199.199.199.5, 1433 or MYSVR, 1433. **Note:** Address is not valid for the system information file.
AnsiNPW	AnsiNPW={yes | no}. When yes, the driver uses ANSI-defined behaviors for handling NULL comparisons, character data padding, warnings, and NULL concatenation. When no, ANSI defined behaviors are not exposed.
APP	Name of the application calling SQLDriverConnect (optional). If specified, this value is stored in the master.dbo.sysprocesses column program_name and is returned by sp_who and the Transact-SQL APP_NAME function.
DATABASE	Name of the default SQL Server database for the connection. If Database is not specified, the default database defined for the login is used. The default database from the ODBC data source overrides the default database defined for the login. The database must be an existing database unless AttachDBFileName is also specified. If AttachDBFileName is specified, the primary file it points to is attached and given the database name specified by DATABASE.
LANGUAGE	SQL Server language name (optional). SQL Server can store messages for multiple languages in sysmessages. If connecting to a SQL Server with multiple languages, Language specifies which set of messages are used for the connection.

UNIX

***Table 11-2. Connection String Attributes on UNIX** (cont.)*

Attribute	Description
PWD	The password for the SQL Server login account specified in the UID parameter. PWD need not be specified if the login has a NULL password or when using Windows NT authentication (Trusted_Connection = yes).
QuotedID	QuotedID={yes | no}. When yes, QUOTED_IDENTIFIERS is set ON for the connection, and SQL Server uses the SQL-92 rules regarding the use of quotation marks in SQL statements. When no, QUOTED_IDENTIFIERS is set OFF for the connection, and SQL Server follows the legacy Transact-SQL rules regarding the use of quotation marks in SQL statements.
TDS	TDS={7.0 | 4.2}. Determines the version of TDS. Use TDS=7.0 to connect to SQL Server 7.0 databases. Use TDS=4.2 to connect to SQL Server 6.5 databases.
UID	A valid SQL Server login account. UID need not be specified when using Windows NT authentication. **Note:** UID is not valid for the system information file; you must use LogonID.

UNIX

***Table 11-2. Connection String Attributes on UNIX** (cont.)*

Attribute	Description
UseProcForPrepare *SQL Server 6.5 and earlier only*	UseProcForPrepare={0 | 1 | 2}. When 0, the SQL Server ODBC driver does not create temporary stored procedures for SQLPrepare. When 1, instructs the SQL Server ODBC driver to create temporary stored procedures when statements are prepared with SQLPrepare. The temporary stored procedures are not dropped until the connection is broken. When 2, the SQL Server ODBC driver creates temporary stored procedures for SQLPrepare, but only one procedure is created per statement handle and the procedure is dropped when the statement handle becomes invalid or a new SQL statement is prepared.
WSID	Workstation ID. Typically, this is the network name of the computer on which the application resides (optional). If specified, this value is stored in the master.dbo.sysprocesses column hostname and is returned by sp_who and the Transact-SQL HOST_NAME function.

Data Types

Table 11-3 shows how the SQL Server data types are mapped to the standard ODBC data types.

Table 11-3. SQL Server Data Types

SQL Server	ODBC
Binary	SQL_BINARY
Bit	SQL_BIT
Char	SQL_CHAR
Datetime	SQL_TYPE_TIMESTAMP
Decimal	SQL_DECIMAL
Decimal() identity	SQL_DECIMAL
Float	SQL_FLOAT
Image	SQL_LONGVARBINARY
Int	SQL_INTEGER
Int identify	SQL_INTEGER
Money	SQL_DECIMAL
Nchar*	SQL_WCHAR
Ntext*	SQL_WLONGVARCHAR
Numeric	SQL_NUMERIC
Numeric() identity	SQL_NUMERIC
Nvarchar*	SQL_WVARCHAR
Real	SQL_REAL
Smalldatetime	SQL_TYPE_TIMESTAMP
Smallint	SQL_SMALLINT
Smallint identity	SQL_SMALLINT
Smallmoney	SQL_DECIMAL
Sysname	SQL_VARCHAR
Sysname*	SQL_WVARCHAR
Text	SQL_LONGVARCHAR

Table 11-3. SQL Server Data Types *(cont.)*

SQL Server	ODBC
Timestamp	SQL_VARBINARY
Tinyint	SQL_TINYINT
Tinyint identity	SQL_TINYINT
Uniqueidentifier*	SQL_GUID
Varbinary	SQL_VARBINARY
Varchar	SQL_VARCHAR

* Supported by SQL Server 7 only.

Isolation and Lock Levels Supported

SQL Server supports isolation levels 0 (read uncommitted), 1 (read committed), 2 (repeatable read), and 3 (serializable). SQL Server supports row- and table-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

The SQL Server driver supports ODBC conformance level 2.

Number of Connections and Statements Supported

The SQL Server database system supports multiple connections. With two-phased commit, SQL Server supports multiple statements per connection. Otherwise, SQL Server supports a single statement per connection if SQL_AUTOCOMMIT is 0 and multiple statements per connection if SQL_AUTOCOMMIT is 1.

12 Connect ODBC for SQL Server 6

Connect ODBC for SQL Server 6 (the "SQL Server 6 driver") supports the SQL Server 6.5 database system available from Microsoft in the Windows 9*x* and Windows NT environments. It also supports the SQL Server 7.0 database system, but with 6.5 functionality only.

See the README file shipped with your DataDirect product for the file name of the SQL Server 6 driver.

System Requirements

To use the SQL Server 6 driver, you must have the appropriate Microsoft SQL Server DB-Library and Net-Library version installed (version 6.5 for access to 6.5 DBMS; version 7.0 for access to 7.0 DBMS).

The SQL Server 6 driver requires Microsoft client software; it does *not* work with Sybase System 10 or 11 software.

Your database must support catalog stored procedures.

The DB-Library is NTWDBLIB.DLL. The Net-Library you need depends on the network protocol used to connect to the SQL Server. For example, Named Pipes requires DBNMPNTW.DLL, and TCP/IP requires DBMSSOCN.DLL. Contact your Microsoft SQL Server vendor to obtain the appropriate DB-Library and Net-Library.

You must have NTWDBLIB.DLL on your path or in your Windows 9*x* \SYSTEM or Windows NT \SYSTEM32 directory.

Configuring Data Sources

Data sources are configured and modified through the ODBC Administrator. To configure a SQL Server 6 data source:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring a new data source, click **Add**. A list of installed drivers appears. Select SQL Server 6 and click **Finish** to display the ODBC SQL Server 6 Driver Setup dialog box.

   If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC SQL Server 6 Driver Setup dialog box.


ODBC SQL Server 6 Driver Setup
General
Advanced
About
Data Source Name:
Description:
Server Name:
Help
Database Name:
Test Connect
OK
Cancel
Apply

3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 271 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply**.

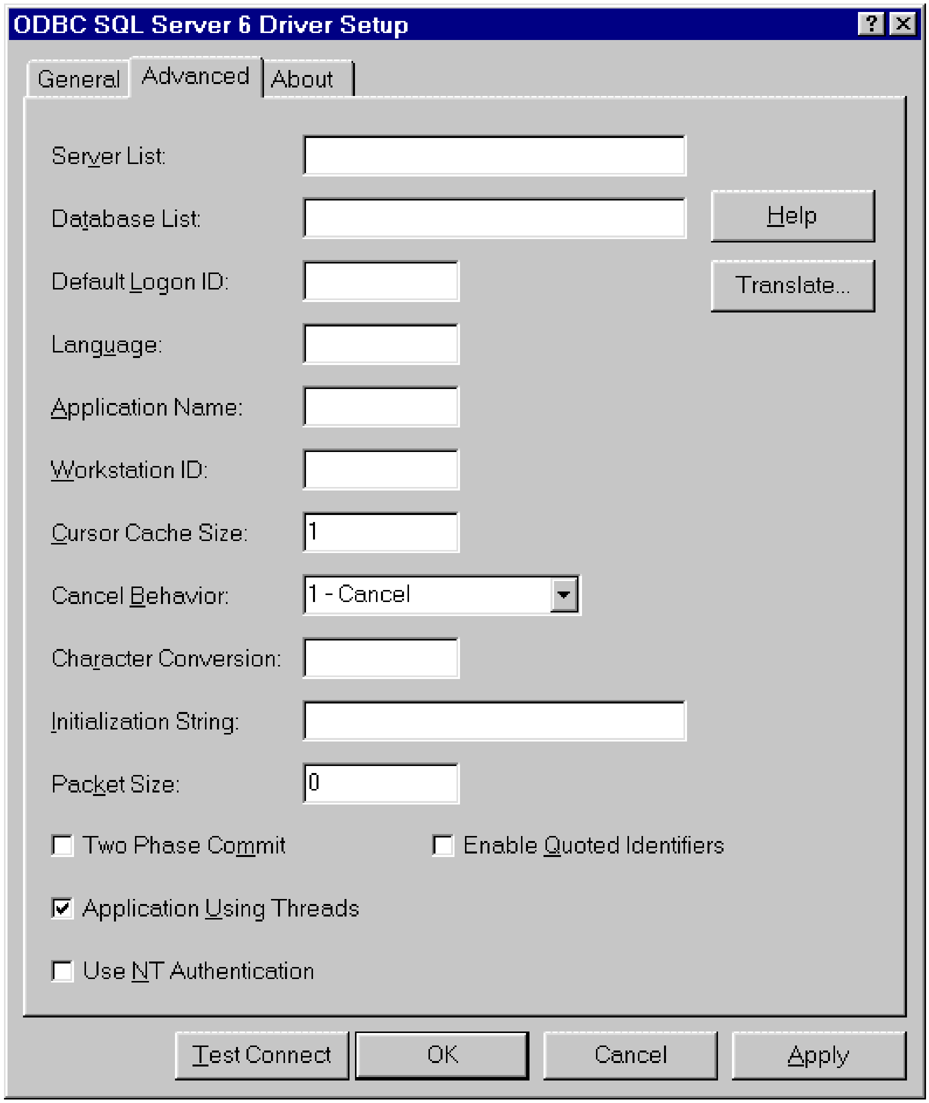
Data Source Name: A string that identifies this SQL Server data source configuration in the system information. Examples include "Accounting" or "SQL Server-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "SQL Server on Server number 1."

Server Name: The name of the server that contains the database you want.

Database Name: The name of the database to which you want to connect by default. If you do not specify a value, the default database defined by SQL Server is used.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

Server List: A comma-separated list of servers that will appear in the Logon dialog box.

Database List: The databases that will be available in the SQL Server Logon Options dialog box. Separate the names with commas.

Default Logon ID: The default logon ID used to connect to your SQL Server database. This ID is case-sensitive. A logon ID is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in the Logon dialog box or connection string.

Language: The national language to be used by the client. The default is English.

Application Name: The name SQL Server uses to identify your application.

Workstation ID: The workstation ID used by the client.

Cursor Cache Size: The number of cursors the cursor cache can hold. The driver creates a cache of statements; each statement represents an open connection to SQL Server. The cursor cache increases performance but uses database resources. The default is 1 (one cursor).

Cancel Behavior: An integer value of 0, 1, or 2 that specifies how a previously executed statement should be canceled.

- 0 fetches all of the remaining records if the statement was a Select.
- 1 cancels the statement by calling dbcancel. This is the default and should be used if dbcancel is supported in your client/server configuration.
- 2 closes the connection to the server for the statement. Use this value only if dbcancel is not supported for your configuration and the performance of fetching all remaining records is unacceptable.

Character Conversion: This value controls the character set conversion between SQL Server and a client application. If you omit this value, no character conversion takes place on your server.

Common values include iso_1 for ISO-8859-1, cp850 for Code Page 850, roman8 for Roman8 character set, and SJIS for a Japanese character set. See your SQL Server documentation for a complete list of values.

Initialization String: The value of this option is a string containing one or more SQL Server commands that you want to run when the data source connection is initialized. Multiple commands must be separated by a semicolon (;).

Packet Size: A value of -1, 0, or *x* that determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance.

When set to 0, the default, the driver uses the default packet size as specified in the server configuration.

When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information.

When set to *x*, an integer from 1 to 10, which indicates a multiple of 512 bytes (for example, 6 means to set the packet size to 6 * 512 = 3072 bytes).

Note that the ODBC specification identifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, the ODBC connect option will take precedence.

Two-Phase Commit: Enables you to have two active statements within a transaction, using the SQL Server two-phase commit services, when this check box is selected. The active statements may deadlock if they reference the same SQL Server table.

Application Using Threads: Ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread-safety standards.

Use NT Authentication: Enables Windows NT security. When enabled, the Default Logon ID field is inactive because Windows NT security passes the logon ID and password. Activating this check box also activates the corresponding check box on the Logon Dialog.

Enable Quoted Identifiers: Enables quoted identifiers; that is, identifiers in SQL Server can be quoted using a quoting character. The default is not selected.

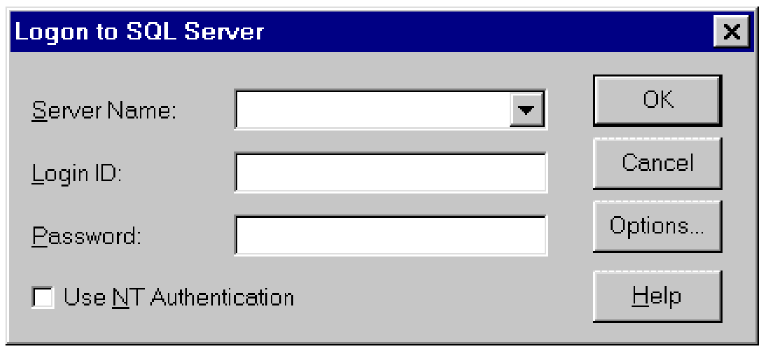
Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

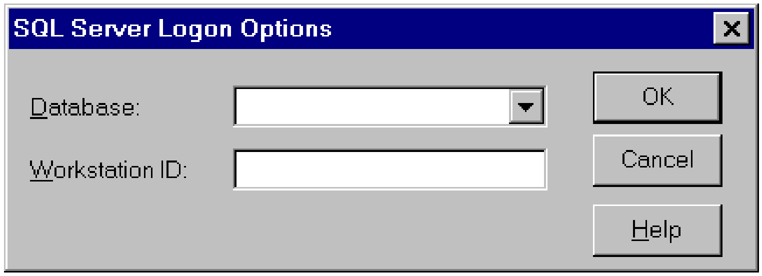
Some ODBC applications display a Logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For SQL Server, the dialog box is as follows:



In this dialog box, do the following:

1. Type the name of the server containing the SQL Server database tables you want to access (case-sensitive) or select the name from the Server Name drop-down list, which displays the server names you specified in the ODBC SQL Server Driver Setup dialog box.
2. If required, type your case-sensitive login ID.
3. If required, type your case-sensitive password for the system.
4. Use NT Authentication enables Windows NT security. When enabled, the Login ID and Password fields are inactive because Windows NT security passes the login ID and password. Activating this check box also activates the corresponding check box on the Advanced Tab.

5 You can click **Options** to display the SQL Server Logon Options dialog box and specify the initial SQL Server database to connect to and the name of your workstation.



6 Click **OK** to log on to the SQL Server database installed on the server you specified and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

DSN=*data_source_name*[;*attribute=value*[;*attribute=value*]...]

An example of a connection string for SQL Server 6 is:

```
DSN=Accounting;DB=PAYROLL;UID=JOHN;PWD=XYZZY
```

Table 12-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 12-1. SQL Server 6 Connection String Attributes

Attribute	Description
ApplicationName (APP)	The name SQL Server uses to identify your application.
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread-safety standards.
Cancel (CAN)	Cancel={0 | 1 | 2}. This attribute specifies how a previously executed statement should be canceled. Valid values are ■ Cancel=0 fetches all remaining records if the statement was a Select. ■ Cancel=1 cancels the statement by calling dbcancel. Set Cancel=1 if dbcancel is supported in your client/server configuration. This is the default. ■ Cancel=2 closes the connection to the server for the statement. Set Cancel=2 only if dbcancel is not supported for your configuration and the performance of fetching all remaining records is unacceptable.

Table 12-1. SQL Server 6 Connection String Attributes *(cont.)*

Attribute	Description
CharConv (CC)	A value that controls the character set conversion between SQL Server (version 4.8 or later) and a client application. Common values include iso_1 for ISO-8859-1, cp850 for Code Page 850, roman8 for the Roman8 character set, and SJIS for a Japanese character set. See your SQL Server documentation for a complete list of values.
CursorCacheSize (CCS)	The number of cursors the cursor cache can hold. The driver creates a cache of statements; each statement represents an open connection to SQL Server. The cursor cache increases performance but uses database resources. The default is 1.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies a SQL Server data source configuration in the system information. Examples include "Accounting" or "SQL Server-Serv1."
EnableQuoted Identifiers (EQI)	EnableQuotedIdentifiers={0 | 1}. Enables quoted identifiers; that is, identifiers in SQL Server can be quoted using a quoting character. The default is 0.
InitializationString (IS)	The value of this option is a string containing one or more SQL Server commands that you want to run when the data source connection is initialized. Multiple commands must be separated by a semicolon (;).
Language (LANG)	The national language to be used by the client. The default is English.
LogonID (UID)	The case-sensitive logon ID used to connect to your SQL Server database. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID.

***Table 12-1. SQL Server 6 Connection String Attributes** (cont.)*

Attribute	Description
ModifySQL (MS)	ModifySQL={0 | 1}. Provided for backward compatibility. It determines whether the driver modifies SQL statements to conform to ODBC specifications or passes the SQL statement directly to SQL Server. Specify ModifySQL=1 to have the driver modify the SQL statement to conform to ODBC specifications. Specify ModifySQL=0 to have the driver understand SQL dialects found in earlier drivers. The default is 1.
PacketSize (PS)	PacketSize={-1 | 0 | *x*}. Determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance. When set to 0, the default, the driver uses the default packet size as specified in the server configuration. When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information. When set to *x*, an integer from 1 to 10, which indicates a multiple of 512 bytes (for example, PacketSize=6 means to set the packet size to 6 * 512 = 3072 bytes). Note that the ODBC specification specifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, the ODBC connect option will take precedence.
Password (PWD)	A case-sensitive password.
ServerName (SRVR)	The name of the server containing the SQL Server tables you want to access.

Table 12-1. SQL Server 6 Connection String Attributes (cont.)

Attribute	Description
TwoPhaseCommit (TPC)	TwoPhaseCommit={0 | 1}. Enables two or more active statements within a transaction, using the SQL Server two-phase commit services. Set TwoPhaseCommit=1 to use two-phase commit. The active statements may deadlock if they reference the same SQL Server table. Otherwise, set TwoPhaseCommit=0 (the default).
UseNTAuthentication (UNA)	UseNTAuthentication={0 | 1}. Enables Windows NT security. When enabled (1), the Default Logon ID field is inactive because Windows NT security passes the logon ID and password. Not enabled (0) is the default.
WorkstationID (WKID)	The workstation ID used by the client.

Data Types

Table 12-2 shows how the SQL Server 6 data types are mapped to the standard ODBC data types.

Table 12-2. SQL Server 6 Data Types

SQL Server 6	ODBC
Binary	SQL_BINARY
Bit	SQL_BIT
Char	SQL_CHAR
Datetime	SQL_TYPE_TIMESTAMP
Decimal	SQL_DECIMAL
Decimal() identify	SQL_DECIMAL

Table 12-2. SQL Server 6 Data Types (cont.)

SQL Server 6	ODBC
Float	SQL_FLOAT
Image	SQL_LONGVARBINARY
Int	SQL_INTEGER
Int identify	SQL_INTEGER
Money	SQL_DECIMAL
Numeric	SQL_NUMERIC
Numeric() identity	SQL_NUMERIC
Real	SQL_REAL
Smalldatetime	SQL_TYPE_TIMESTAMP
Smallint	SQL_SMALLINT
Smallint identity	SQL_SMALLINT
Smallmoney	SQL_DECIMAL
Sysname	SQL_VARCHAR
Text	SQL_LONGVARCHAR
Timestamp	SQL_VARBINARY
Tinyint	SQL_TINYINT
Tinyint identity	SQL_TINYINT
Varbinary	SQL_VARBINARY
Varchar	SQL_VARCHAR

Isolation and Lock Levels Supported

SQL Server supports isolation levels 1 (read committed) and 3 (serializable). SQL Server supports page-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the SQL Server 6 driver.

In addition, the following functions are supported:

- SQLColumnPrivileges
- SQLForeignKeys
- SQLPrimaryKeys
- SQLProcedureColumns
- SQLProcedures
- SQLTablePrivileges
- SQLSetPos

Scrollable cursors are supported with SQLExtendedFetch and SQLFetchScroll. The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The SQL Server database system supports multiple connections. With two-phased commit, SQL Server supports multiple statements per connection. Otherwise, SQL Server supports a single statement per connection if SQL_AUTOCOMMIT is 0 and multiple statements per connection if SQL_AUTOCOMMIT is 1.

13 Connect ODBC for SQLBase

Connect ODBC for SQLBase (the "SQLBase driver") supports the Centura Software SQLBase database system in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the SQLBase driver.

System Requirements

To communicate with the SQLBase server, the SQLBase driver requires the SQLBase 7.0 client software with PTF4 or higher, which includes the following shared libraries: SQLWNTM.DLL, SQLNGCI.DLL, and a communication DLL (for example, SQLNPIPE.DLL for Named Pipes). The directory containing these files must be on your path.

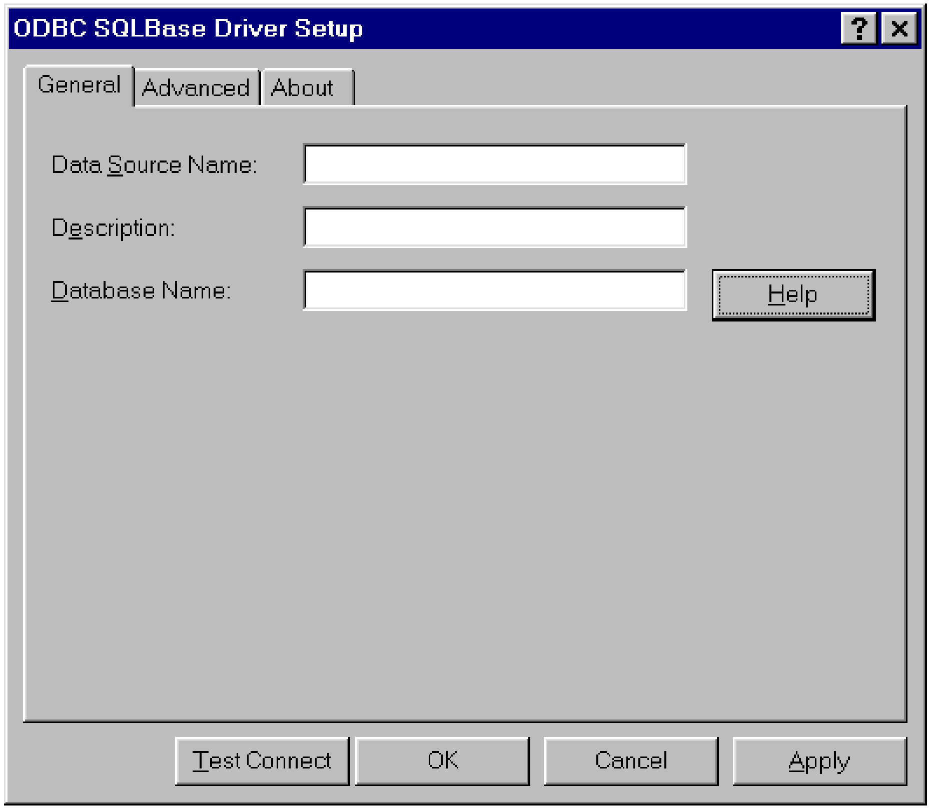
You must have version 6.*x* or higher of SQLBase.

Configuring Data Sources

Data sources are configured and modified through the ODBC Administrator. To configure a SQLBase data source:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC SQLBase Driver Setup dialog box.

If you are configuring a new data source, click **Add**. A list of installed drivers appears. Select the SQLBase driver and click **Finish** to display the ODBC SQLBase Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 284 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.

- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

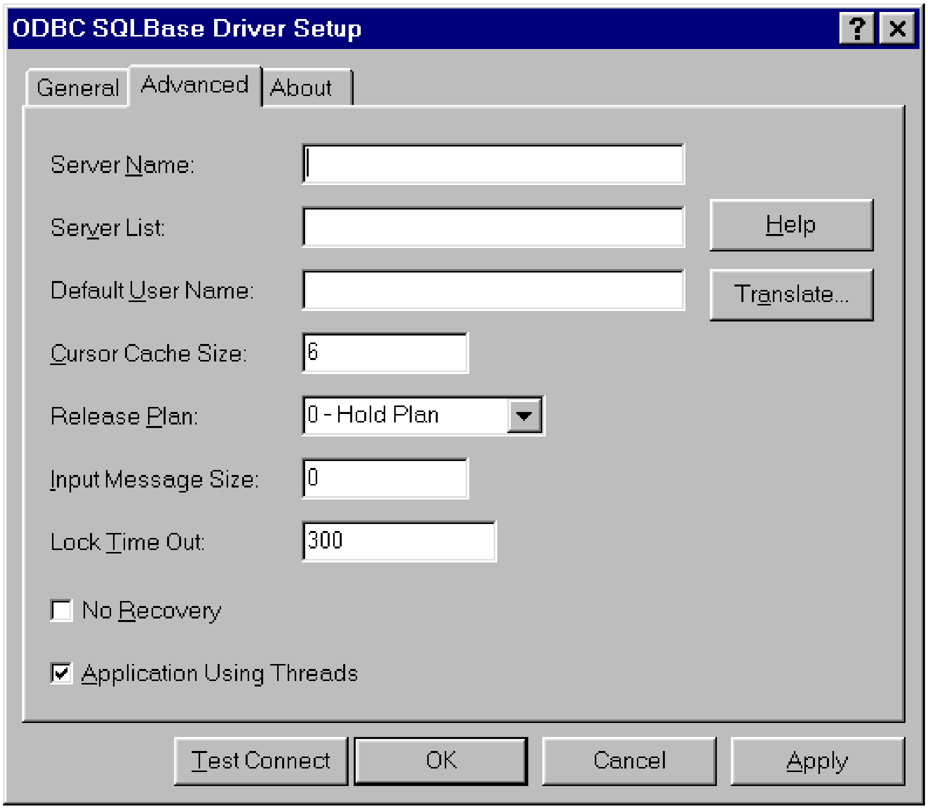
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this SQLBase data source configuration in the system information. Examples include "Accounting" or "SQLBase-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "SQLBase on Server number 1."

Database Name: The name of the database to which you want to connect by default.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Server Name: The name of the server that contains the desired database. Specify the word Local if you are using the local server.

The server name is not required to log on. The dialog box appears more quickly if you do not specify a server name. If you do specify a server name, the Database Name drop-down list in the Logon dialog box is populated with the names of the databases available on that server.

Server List: A comma-separated list of servers that will appear in the Logon dialog box. Specify Local to add the local server to the list.

Default User Name: The default user name used to connect to your SQLBase database. A user name is required only if security is enabled on your database. Your ODBC application may override this value or you may override this value in the Logon dialog box or connection string.

Cursor Cache Size: The number of cursors the cursor cache can hold. The default is 6.

Release Plan: A value of 0 or 1 that determines whether a lock is maintained on a table when the cursors accessing the table are freed. Freeing the lock on the table results in a request to the server, which can decrease performance but will always allow you to Drop or Alter the table.

- 0. Hold Plan, the default—no locks on tables are freed.
- 1. Free Plan—locks are freed.

Input Message Size: The number of bytes in the input message buffer. The default is determined by SQLBase. Increasing this value retrieves more records across the network in a single fetch.

Lock Time Out: The number of seconds SQLBase should wait for a lock to be freed before raising an error. Values can be -1 (wait forever) to 1800; the default is 300.

No Recovery: Select this check box to disable transaction recovery. Selecting this box is dangerous because your database can become inconsistent in the event of a system failure.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

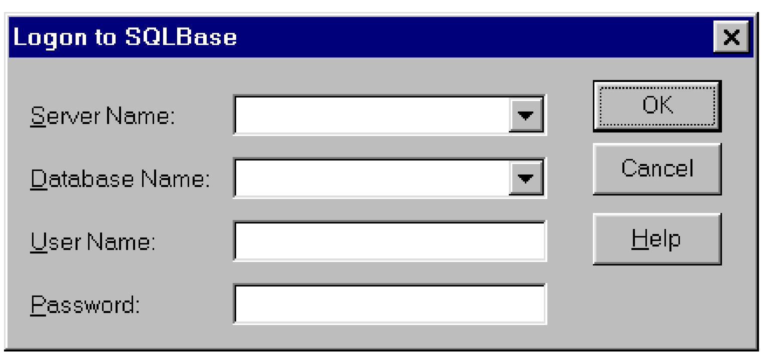
Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a Logon dialog box when you are connecting to a data source. For SQLBase, the dialog box is as follows:



In this dialog box, do the following:

1. Optionally, type the name of the server containing the SQLBase database tables you want to access or select the name from the Server Name drop-down list, which displays the server names you specified in the Setup dialog box. Specify Local to access a local SQLBase database.
2. Type the name of the database you want to access. If you specified a server name, you can select the name from the Database Name drop-down list.
3. If required, type your user name.
4. If required, type your password.
5. Click **OK** to complete the logon and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for SQLBase is:

```
DSN=SQLBASE TABLES;SRVR=QESRVR;DB=PAYROLL;UID=JOHN;PWD=XYZZY
```

Table 13-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 13-1. SQLBase Connection String Attributes

Attribute	Description
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.
CursorCacheSize (CCS)	The number of cursors the cursor cache can hold. The cursor cache increases performance and uses few database resources. The initial default is 6.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies a SQLBase data source configuration in the system information. Examples include "Accounting" or "SQLBase-Serv1."
InputMessageSize (IMS)	An integer value that determines the number of bytes of the input message buffer. Increasing this value retrieves more records across the network in a single fetch. The initial default is determined by SQLBase.
LockTimeOut (LTO)	The number of seconds SQLBase should wait for a lock to be freed before raising an error. Values can be -1 to 1800; -1 means wait forever. The initial default is 300.

Table 13-1. SQLBase Connection String Attributes (cont.)

Attribute	Description
LogonID (UID)	The default logon ID (user name) used to connect to your SQLBase database. If so, contact your system administrator to get your logon ID. A logon ID is required only if security is enabled on your database.
NoRecovery (NR)	NoRecover={0 | 1}. This attribute enables or disables transaction recovery. NoRecovery=0 (the initial default) enables recovery; NoRecovery=1 disables recovery. NoRecovery=1 improves performance but is dangerous because your database can become inconsistent in the event of a system crash. See your SQLBase documentation for information on this option.
Password (PWD)	A case-sensitive password.
ReleasePlan (RP)	ReleasePlan={0 | 1}. This attribute determines whether a lock is maintained on a table when the cursors accessing the table are freed. Freeing the lock on the table results in a request to the server, which can decrease performance but will always allow you to Drop or Alter the table. When set to 0, the initial default, no locks on tables are freed. When set to 1, locks are freed.
ServerName (SRVR)	The name of the server containing the SQLBase database tables you want to access. Specify ServerName=Local if you are using the local server.
Servers (SRVRLIST)	A comma-separated list of servers with which to prompt the user in a Logon dialog box. Specify Local to add the local server to the list.

Data Types

Table 13-2 shows how the SQLBase data types are mapped to the standard ODBC data types.

Table 13-2. SQLBase Data Types

SQLBase	ODBC
Char	SQL_VARCHAR
Date	SQL_TYPE_DATE
Decimal	SQL_DECIMAL
Double Precision	SQL_DOUBLE
Integer	SQL_INTEGER
Long Varchar	SQL_LONGVARCHAR
Number	SQL_DOUBLE
Real	SQL_REAL
Smallint	SQL_SMALLINT
Time	SQL_TYPE_TIME
Timestamp	SQL_TYPE_TIMESTAMP
Varchar	SQL_VARCHAR

Isolation and Lock Levels Supported

SQLBase supports isolation levels 1 (read committed, the default) and 3 (serializable). SQLBase also supports an alternative isolation level 1 called cursor stability. Your ODBC application can use this isolation level by calling SQLSetConnectOption (1040,1).

SQLBase supports page-level locking.

See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the SQLbase driver. In addition, the following functions are supported:

- SQLColumnPrivileges
- SQLForeignKeys
- SQLPrimaryKeys
- SQLProcedures
- SQLSetPos
- SQLTablePrivileges

The driver also supports backward and random fetching in SQLExtendedFetch and SQLFetchScroll. It supports the core SQL grammar.

Number of Connections and Statements Supported

The SQLBase database system supports multiple connections and multiple statements per connection.

14 Connect ODBC for Sybase

Connect ODBC for Sybase (the "Sybase driver") supports the SQL Server System 10, System 11, and Adaptive Server 11.5 and higher database systems from Sybase in the Windows 9*x*, Windows NT and UNIX environments. The driver supports the SQL Server 4.9.2 database system in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the Sybase driver.

System Requirements

The following section lists requirements for all supported platforms.

Windows 9*x* and Windows NT

You must install the Sybase Open Client-Library, version 10.0.4 or higher, and the appropriate Sybase Net-Library to gain access to the Sybase server.

SQLEdit is a tool that allows you to define servers and adds them to SQL.INI.

SYBPING is a tool that is provided to test connectivity from your client workstation to the database server (servers that are added through SQLEdit). Use this tool to test your connection.

Set the environment variable SYBASE to the directory where you installed the Sybase Open Client. For example:

```
set SYBASE=C:\SQL10
```

Enabling MTS

If you have installed the server version of the Sybase driver, you can take advantage of Microsoft Transaction Server (MTS) capabilities, specifically, the Distributed Transaction Coordinator (DTC). For a general discussion of MTS and the DTC, refer to the help file of the "MicroSoft Transaction Server SDK."

To enable support for the DTC, select the Advanced Tab from the Sybase driver setup and select the appropriate choice from the Distributed Transaction Model drop-down list.

Note: To use DTC, you must be connected to a Version 12.0 server using 12.0 clients.

UNIX

Before you can use the System data source, you must have the Sybase Open Client Net-Libraries you plan to use installed on your workstation in the $SYBASE source tree.

Set the environment variable SYBASE to the directory where you installed the System client. For example, for C-shell users, the following syntax is valid:

```
setenv SYBASE /databases/sybase
```

For Bourne- or Korn-shell users, the following syntax is valid:

```
SYBASE=/databases/sybase;export SYBASE
```

You must include the directory containing the System client-shared libraries in the environment variable LD_LIBRARY_PATH (on Solaris), LIBPATH (on AIX), and

SHLIB_PATH (on HP-UX). For example, for C-shell users, the following syntax is valid:

```
setenv LD_LIBRARY_PATH
/databases/sybase/lib:$LD_LIBRARY_PATH
```

For Bourne- or Korn-shell users, the following syntax is valid:

```
LD_LIBRARY_PATH=/databases/sybase/lib:$LD_LIBRARY_
PATH;export LD_LIBRARY_PATH
```

In non-DCE environments, users should use the ivsyb*xx* Sybase driver that requires the library libct. For DCE environments, users should use the ivsyb11*xx* Sybase driver that requires the Sybase 11.1 client library libct_r.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

Note: In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 14-1 on page 306. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure a Sybase data source:

1. Start the ODBC Administrator to display a list of data sources.
2. If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Sybase Driver Setup dialog box.

If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the Sybase driver and click **Finish** to display the ODBC Sybase Driver Setup dialog box.

3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 304 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message.

  Verify that all required client software is properly installed. If it is not, you will see the message:

  ```
  Specified driver could not be loaded due to
  system error [xxx].
  ```

  Click **OK**.

4 Specify values for the following; then, click **Apply**.

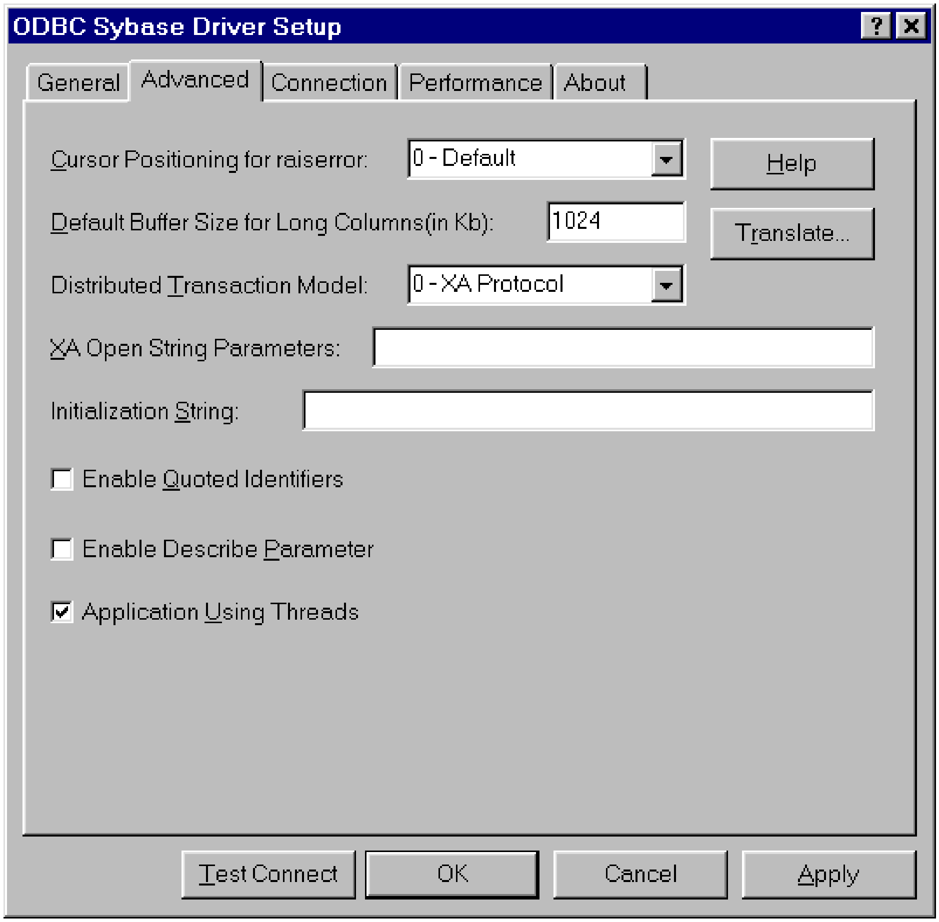
Data Source Name: A string that identifies this Sybase data source configuration in the system information. Examples include "Accounting" or "Sys10-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "System 10 on Server number 1."

Server Name: The name of the server that contains the Sybase tables you want to access. If not supplied, the server name in the DSQUERY environment variable is used. On UNIX, the name of a server from your $SYBASE/interfaces file.

Database Name: The name of the database to which you want to connect by default. If you do not specify a value, the default is the database defined by the system administrator for each user.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

Initialization String: Supports the running of Sybase commands at connect time. Multiple commands must be separated by semicolons.

Default Buffer Size for Long Columns (in Kb): An integer value that specifies, in 1024-byte multiples, the maximum length of data fetched from a TEXT or IMAGE column. The default is 1,024 kilobytes. You will need to increase this value if the total size of any long data that you wish to insert, update, or retrieve exceeds 1 megabyte.

Distributed Transaction Model: From this drop-down list, select XA protocol or native OLE transactions. To use native OLE transactions, the Adaptive Server Enterprise must be running on Windows NT.

XA Open String Parameters: An edit field that allows you to add options to the open string passed by the driver to the XA libraries. You should not use this feature under normal circumstances. See Sybase documentation on the XA libraries for details concerning possible options.

Enable Quoted Identifiers: Allows support of quoted identifiers in Sybase servers.

Enable Describe Parameter: Check this box to enable the SQLDescribeParam function, which allows an application to describe parameters in SQL statements and in stored procedure calls. To use this option, Prepare Method must be set to 0 or 1, and the SQL statement must not include long parameters. This option should be checked when using Microsoft Remote Data Objects (RDO) to access data.

Application Using Threads: Ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Cursor Positioning for raiserror: A value of 0 or 1 that specifies when the error is returned and where the cursor is positioned when raiserror is encountered.

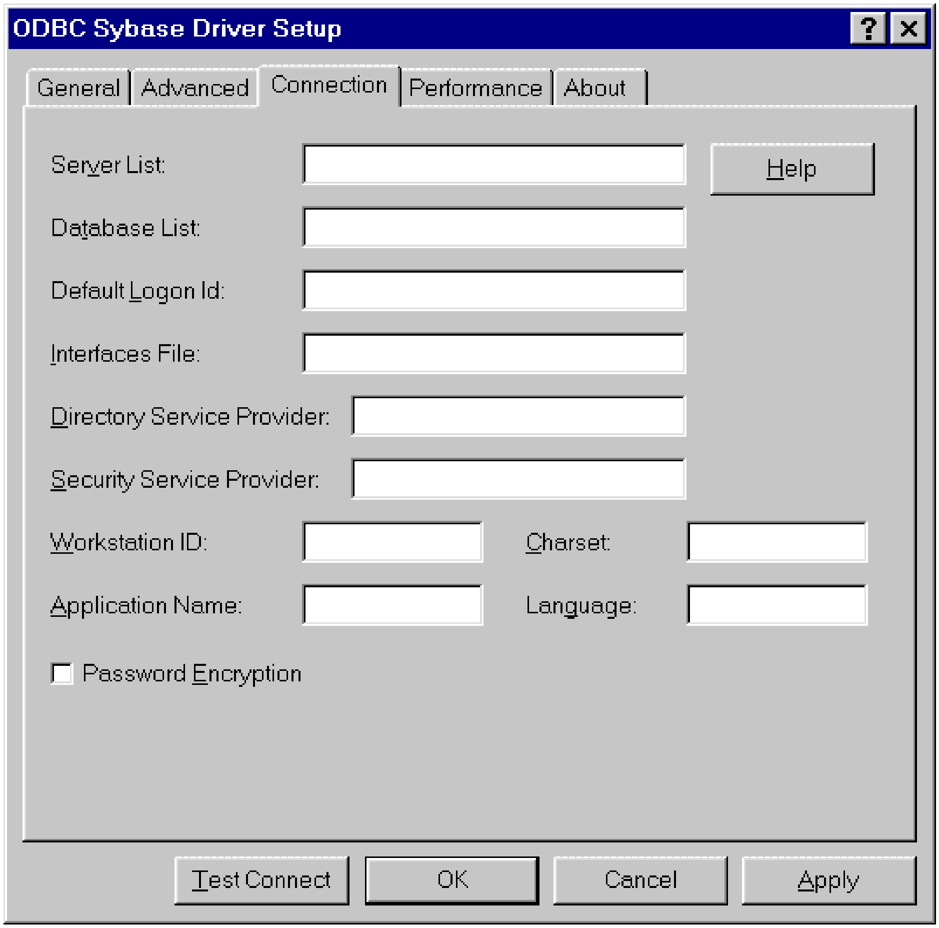
When set to 0 (the default), raiserror is handled separately from surrounding statements. The error is returned when raiserror is processed via SQLExecute, SQLExecDirect, or SQLMoreResults. The result set is empty.

When set to 1 (MS compatible), raiserror is handled with the next statement. The error is returned when the next statement is processed; the cursor is positioned on the first row of subsequent result set. This could result in multiple raiserrors being returned on a single execute.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click the **Connection** tab to configure optional data source settings.



8 Specify values for the following; then, click **Apply**.

Server List: The list of servers that appear in the logon dialog box. Separate the server names with commas.

Database List: The databases that appear in the logon dialog box. Separate the names with commas.

Default Logon ID: The default logon ID used to connect to your Sybase database. This ID is case-sensitive. A logon ID is required only if security is enabled for the database you are connecting to. Your ODBC application may override this value or you can override this value in the logon dialog box or connection string.

Interfaces File: The path name of the interfaces file. The default is the normal Sybase interfaces file.

Workstation ID: The workstation ID used by the client.

Charset: The name of a character set corresponding to a subdirectory in $SYBASE/charsets. The default is the setting on the Sybase server.

Application Name: The name used by Sybase to identify your application.

Language: The national language corresponding to a subdirectory in $SYBASE/locales. The default is English.

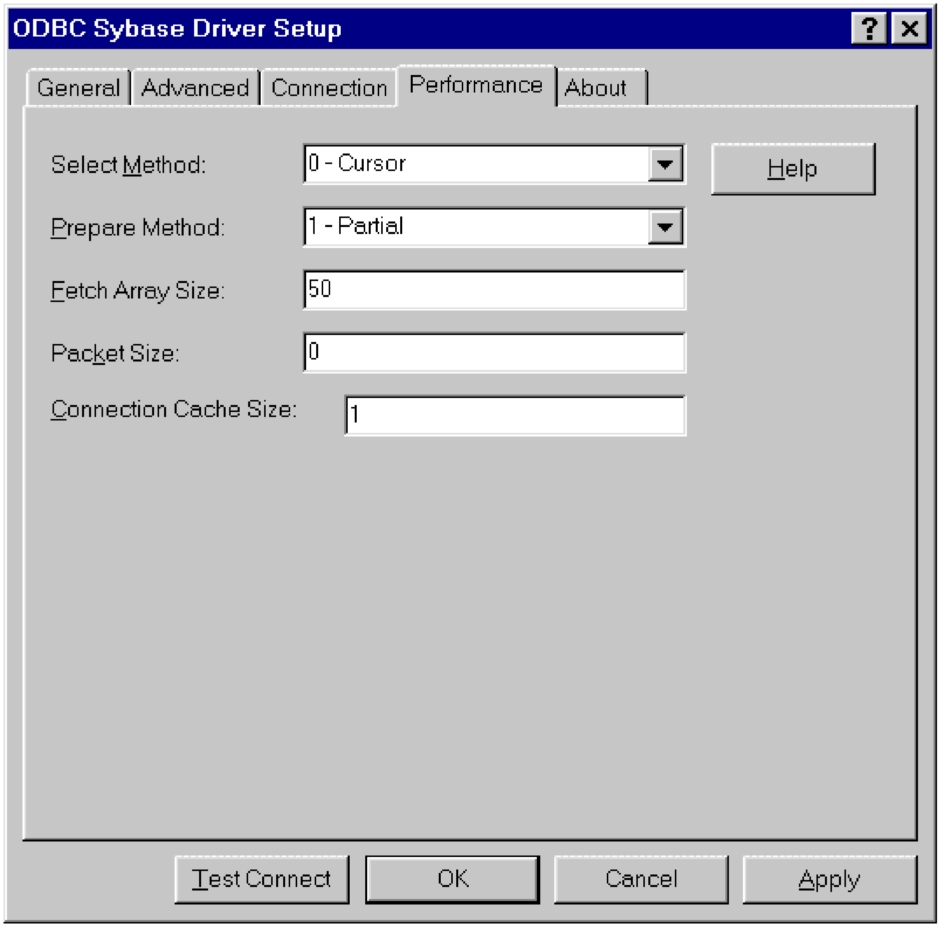
Directory Service Provider: A string that indicates which Directory Service Provider the Sybase Open Client uses when connecting with this data source. The available Directory Service Providers can be found using the OpenClient/OpenServer Configuration Utility that is installed with Sybase Open Client version 11.1 or higher. If the client is not using Open Client version 11.1 or higher, this option is ignored.

Security Service Provider: A string that indicates which Security Service Provider the Sybase Open Client uses when connecting with this data source. The available Security Service Providers can be found using the OpenClient/OpenServer Configuration Utility that is installed with Sybase Open Client version 11.1 or higher. If the client is not using Open Client version 11.1 or higher, this option is ignored.

Password Encryption: A value that determines whether password encryption can be performed from the Open Client

Library to the server. Checking this box enables password encryption.

9 Click the **Performance** tab to configure performance settings for this data source.



10 Specify values for the following; then, click **Apply**.

Prepare Method: A value of 0, 1, 2, or 3 that determines whether stored procedures are created on the server for calls to SQLPrepare. This setting is ignored when connected to Sybase 4.9.2, executing as if set to value 2.

When set to 0, stored procedures are created for every call to SQLPrepare. This setting can result in decreased performance when processing statements that do not contain parameters.

When set to 1 (the initial default), the driver creates stored procedures only if the statement contains parameters. Otherwise, the statement is cached and run directly at the time of SQLExecute.

When set to 2, stored procedures are never created. The driver caches the statement, executes it directly at the time of SQLExecute, and reports any syntax or similar errors at the time of SQLExecute.

When set to 3, stored procedures are never created. This is identical to value 2 except that any syntax or similar errors are returned at the time of SQLPrepare instead of SQLExecute. Use this setting only if you must have syntax errors reported at the time of SQLPrepare.

Fetch Array Size: The number of rows the driver retrieves when fetching from the server. This is not the number of rows given to the user. The default is 50 rows.

Select Method: A value of 0 or 1 that determines whether database cursors are used for Select statements. When set to 0, the default, database cursors are used; when set to 1, Select statements are run directly without using database cursors. A setting of 1 limits the data source to one active statement. This setting is ignored when connected to Sybase 4.9.2 servers.

Packet Size: A value of -1, 0, or *x* that determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance.

When set to 0, the default, the driver uses the default packet size as specified in the Sybase server configuration.

When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information.

When set to *x*, an integer from 1 to 1024, the driver uses a packet size represented by *x* times 512 bytes. For example, "6" means to set the packet size to 6 * 512 bytes (3072 bytes).

To take advantage of this connection attribute, you must configure the Sybase server for a maximum network packet size greater than or equal to the value you specified for PacketSize. For example:

```
sp_configure "maximum network packet size",
5120
reconfigure
Restart Sybase Server
```

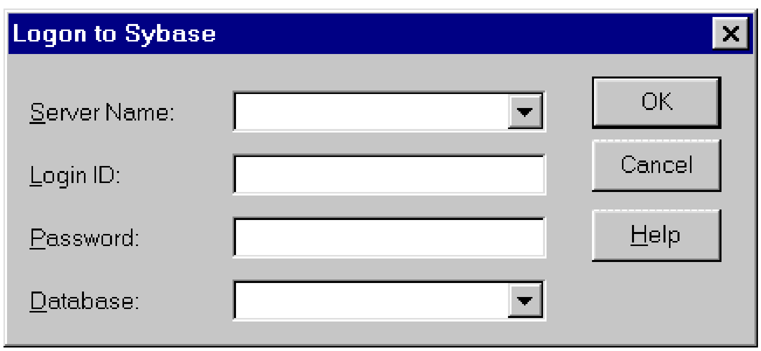
Note that the ODBC specification identifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, they have been defined as mutually exclusive. If PacketSize is specified, you will receive a message "Driver Not Capable" if you attempt to call SQL_PACKET_SIZE. If you do not set PacketSize, then application calls to SQL_PACKET_SIZE are accepted by the driver.

Connection Cache: A value that determines the number of connections that the connection cache can hold. The default Connection Cache setting is 1. To set the connection cache, you must set the Select Method option to 1 - Direct. Increasing the connection cache may increase performance of some applications but requires additional database resources.

11 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a Logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For Sybase, the dialog box is as follows:



In this dialog box, do the following:

1 Type the case-sensitive name of the server containing the Sybase database tables you want to access or select the name from the Server Name drop-down list, which displays the server names you specified in the ODBC Sybase Driver Setup dialog box.

2 If required, type your case-sensitive login ID.

3 If required, type your case-sensitive password for the system.

4. Type the name of the database you want to access (case-sensitive) or select the name from the Database drop-down list, which displays the names you specified in the ODBC Sybase Driver Setup dialog box.

5. Click **OK** to complete the logon and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Sybase is:

```
DSN=SYS10 TABLES;SRVR=QESRVR;DB=PAYROLL;UID=JOHN;PWD=XYZZY
```

Table 14-1 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 14-1. Sybase Connection String Attributes

Attribute	Description
ApplicationName (APP)	The name used by Sybase to identify your application.
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.
ArraySize (AS)	The number of rows the driver retrieves from the server for a fetch. This is not the number of rows given to the user. This increases performance by reducing network traffic. The initial default is 50 rows.
Charset (CS)	The name of a character set corresponding to a subdirectory in $SYBASE/charsets.
CursorCacheSize (CCS)	The number of connections that the connection cache can hold. The initial default value for CursorCacheSize is 1 (one cursor). To set the connection cache, you must set the SelectMethod attribute to 1. Increasing the connection cache may increase performance of some applications but requires additional database resources.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies a single connection to a Sybase database. Examples include "Accounting" or "Sys10-Serv1."

Table 14-1. Sybase Connection String Attributes *(cont.)*

<table>
<tr><th>Attribute</th><th>Description</th></tr>
<tr><td>DefaultLongData BuffLen (DLDBL)</td><td>An integer value that specifies, in 1024-byte multiples, the maximum length of data fetched from a TEXT or IMAGE column. The default is DefaultLongDataBuffLen=1024. You will need to increase this value if the total size of any long data exceeds 1 megabyte.</td></tr>
<tr><td>DirectoryService Provider (DSP)</td><td>A string that indicates which Directory Service Provider the Sybase Open Client uses when connecting with this data source. The available Directory Service Providers can be found using the OpenClient/OpenServer Configuration Utility that is installed with Sybase Open Client version 11.1 or higher. If the client is not using Open Client version 11.1 or higher, this option is ignored.</td></tr>
<tr><td>Distributed TransactionModel (DTM)</td><td>DistributedTransactionModel={0 | 1}. When set to 0, selects XA Protocol (the default). When set to 1, selects native OLE transactions. To use native OLE transactions, the Adaptive Server Enterprise must be running on Windows NT.</td></tr>
<tr><td>EnableDescribe Param (EDP)</td><td>EnableDescribeParam={0 | 1}. When set to 1, enables the ODBC API function SQLDescribeParam, which allows an application to describe parameters in SQL statements and in stored procedure calls. To use this option, OptimizePrepare must be set to 0 or 1, and the SQL statement must not include long parameters. This option should be set to 1 when using Microsoft Remote Data Objects (RDO) to access data. The default is 0.</td></tr>
<tr><td>EnableQuoted Identifiers (EQI)</td><td>EnableQuotedIdentifiers={0 | 1}. Specify 1 to allow support of quoted identifiers. The default is 0.</td></tr>
<tr><td>InitializationString (IS)</td><td>InitializationString={<Sybase set commands>;...}. Supports the execution of Sybase commands at connect time. Multiple commands must be separated by semicolons.</td></tr>
<tr><td>InterfacesFile (IFILE)</td><td>The path name to the interfaces file.</td></tr>
</table>

Table 14-1. Sybase Connection String Attributes *(cont.)*

Attribute	Description
Language (LANG)	The national language corresponding to a subdirectory in $SYBASE/locales.
LogonID (UID)	The default logon ID used to connect to your Sybase database. This ID is case-sensitive. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID.
OptimizePrepare (OP)	OptimizePrepare={0 | 1 | 2 | 3}. This attribute determines whether stored procedures are created on the server for calls to SQLPrepare. This setting is ignored when connected to Sybase 4.9.2, executing as if set to value 2. When set to 0, stored procedures are created for every call to SQLPrepare. This setting can result in decreased performance when processing statements that do not contain parameters. When set to 1 (the initial default), the driver creates stored procedures only if the statement contains parameters. Otherwise, the statement is cached and run directly at the time of SQLExecute. When set to 2, stored procedures are never created. The driver caches the statement, executes it directly at the time of SQLExecute, and reports any syntax or similar errors at the time of SQLExecute. When set to 3, stored procedures are never created. This is identical to value 2 except that any syntax or similar errors are returned at the time of SQLPrepare instead of SQLExecute. Use this setting only if you must have syntax errors reported at the time of SQLPrepare.

Table 14-1. Sybase Connection String Attributes (cont.)

Attribute	Description

PacketSize (PS)	PacketSize={-1 | 0 | *x*}. This attribute determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance.
	
	When set to 0, the initial default, the driver uses the default packet size as specified in the Sybase server configuration.
	
	When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information.
	
	When set to x, an integer from 1 to 1024, the driver uses a packet size represented by x times 512 bytes. For example, PacketSize=6 means to set the packet size to 6 * 512 bytes (3072 bytes).
	
	To take advantage of this connection attribute, you must configure the Sybase server for a maximum network packet size greater than or equal to the value you specified for PacketSize. For example:
	
	`sp_configure "maximum network packet size", 5120`
	`reconfigure`
	`Restart Sybase Server`
	
	Note that the ODBC specification specifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, they have been defined as mutually exclusive. If PacketSize is specified, you will receive a message "Driver Not Capable" if you attempt to call SQL_PACKET_SIZE. If you do not set PacketSize, then application calls to SQL_PACKET_SIZE are accepted by the driver.

Password (PWD)	A case-sensitive password.

Table 14-1. Sybase Connection String Attributes *(cont.)*

Attribute	Description
Password Encryption (PE)	PasswordEncryption={0 | 1}. A value that determines whether password encryption can be performed from the Open Client Library to the server. When set to 0, the initial default, this cannot be done. When set to 1, password encryption is enabled.
RaiseErrorPosition Behavior (REPB)	RaiseErrorPositionBehavior={0 | 1}. A value that specifies when the error is returned and where the cursor is positioned when raiserror is encountered. When set to 0 (the default), raiserror is handled separately from surrounding statements. The error is returned when raiserror is processed via SQLExecute, SQLExecDirect, or SQLMoreResults. The result set is empty. When set to 1 (MS compatible), raiserror is handled with the next statement. The error is returned when the next statement is processed; the cursor is positioned on the first row of subsequent result set. This could result in multiple raiserrors being returned on a single execute.
SecurityService Provider (SSP)	A string that indicates which Security Service Provider the Sybase Open Client uses when connecting with this data source. The available Security Service Providers can be found using the OpenClient/OpenServer Configuration Utility that is installed with Sybase Open Client version 11.1 or higher. If the client is not using Open Client version 11.1 or higher, this option is ignored.

Table 14-1. Sybase Connection String Attributes *(cont.)*

Attribute	Description
SelectMethod (SM)	SelectMethod={0 | 1}. This attribute determines whether database cursors are used for Select statements. When set to 0, the initial default, database cursors are used. In some cases performance degradation can occur when performing large numbers of sequential Select statements because of the amount of overhead associated with creating database cursors. When set to 1, Select statements are run directly without using database cursors. When set to 1, the data source is limited to one active statement. This attribute is ignored for Sybase 4.9.2 servers.
ServerName (SRVR)	The name of the server containing the Sybase tables you want to access. If not supplied, the initial default is the server name in the DSQUERY environment variable. On UNIX, the name of a server from your $SYBASE/interfaces file.
WorkstationID (WKID)	The workstation ID used by the client.
XAOpenString Parameters (XAOSP)	A string that adds options to the open string passed by the driver to the XA libraries. You should not use this feature under normal circumstances. See Sybase documentation on the XA libraries for details concerning possible options.

Data Types

Table 14-2 shows how the Sybase data types are mapped to the standard ODBC data types.

Table 14-2. Sybase Data Types

Sybase	ODBC
binary	SQL_BINARY
bit	SQL_BIT
char	SQL_CHAR
datetime	SQL_TYPE_TIMESTAMP
decimal*	SQL_DECIMAL
float	SQL_FLOAT
image	SQL_LONGVARBINARY
int	SQL_INTEGER
money	SQL_DECIMAL
numeric*	SQL_NUMERIC
real	SQL_REAL
smalldatetime	SQL_TYPE_TIMESTAMP
smallint	SQL_SMALLINT
smallmoney	SQL_DECIMAL
sysname	SQL_VARCHAR
text	SQL_LONGVARCHAR
timestamp	SQL_VARBINARY
tinyint	SQL_TINYINT
varbinary	SQL_VARBINARY
varchar	SQL_VARCHAR

* Not supported with Sybase 4.9.2 servers.

Isolation and Lock Levels Supported

Sybase supports isolation levels 0 (read uncommitted, if the server version is 11 or higher), 1 (read committed, the default), 2 (repeatable read), and 3 (serializable). It supports page-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Sybase driver. In addition, the following functions are supported:

- SQLColumnPrivileges
- SQLForeignKeys
- SQLPrimaryKeys
- SQLProcedureColumns
- SQLProcedures
- SQLTablePrivileges

The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The Sybase database system supports multiple connections and multiple statements per connection. If SelectMethod=1, Sybase data sources are limited to one active statement in manual commit mode.

15 Connect ODBC for Sybase ASE

Connect ODBC for Sybase ASE (the "Sybase ASE driver") supports Adaptive Server 11.5 and higher database systems from Sybase in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the Sybase ASE driver.

System Requirements

There are no client requirements for the Sybase ASE driver.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

To configure a Sybase ASE data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Sybase ASE Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the Sybase ASE driver and click **Finish** to display the ODBC Sybase ASE Driver Setup dialog box.

3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box. A logon dialog box is displayed; see "Connecting to a Data Source Using a Logon Dialog Box" on page 325 for details.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Sybase ASE data source configuration in the system information. Examples include "Accounting" or "Sys10-Serv1."

Description: An optional long description of a data source name. For example, "My Accounting Database" or "System 10 on Server number 1."

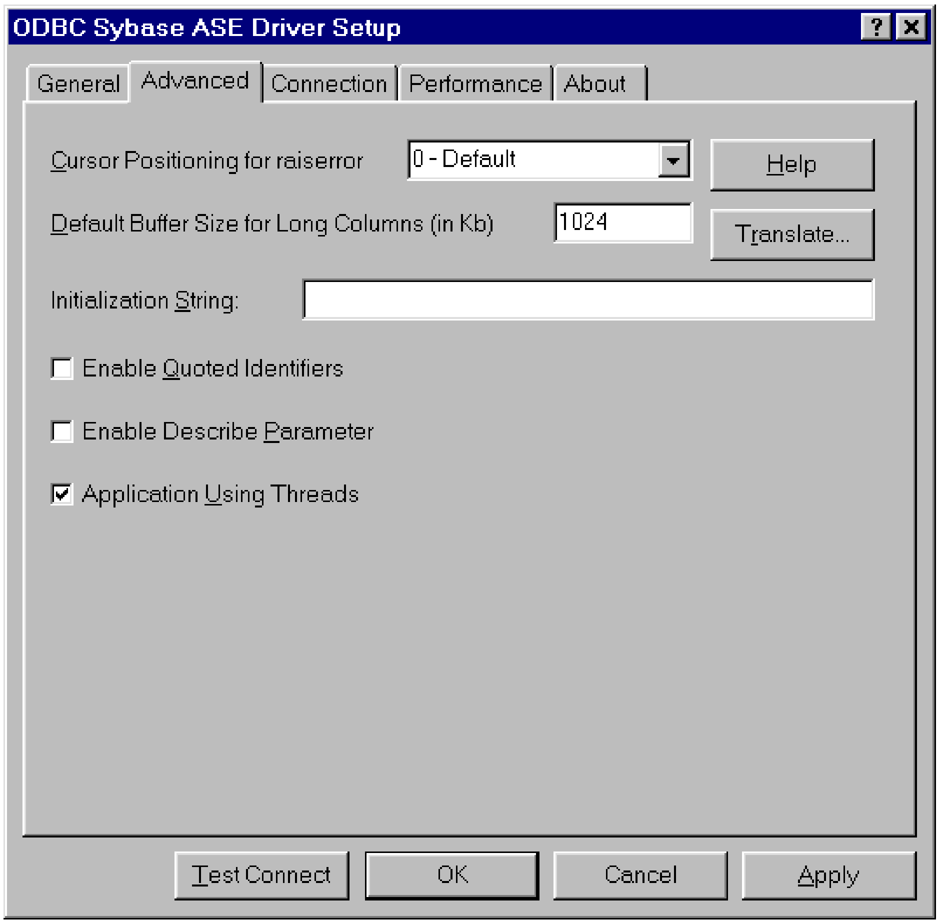
Network Library Name: The name of the network library. This specifies which network protocol to use. The values are Winsock and NamedPipes. The default is Winsock.

Network Address: The network address depends on which network protocol is chosen under Network Library Name and on the Sybase server. If you have chosen Winsock, specify an IP address as follows: "<servername or IP address>, <port number>". For example, if your network supports named servers, you may specify an address such as "Sybaseserver, 5000". You may also specify the IP address directly such as "199.226.224.34, 5000".

If you have chosen NamedPipes as the network protocol, you must specify the pipe address of the server. For example "\\machine1\sybase\pipe\query".

Database Name: The name of the database to which you want to connect by default. If you do not specify a value, the default is the database defined by the system administrator for each user.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Cursor Positioning for raiserror: A value of 0 or 1 that specifies when the error is returned and where the cursor is positioned when raiserror is encountered.

When set to 0 (the default), raiserror is handled separately from surrounding statements. The error is returned when raiserror is processed via SQLExecute, SQLExecDirect, or SQLMoreResults. The result set is empty.

When set to 1 (MS compatible), raiserror is handled with the next statement. The error is returned when the next statement is processed; the cursor is positioned on the first row of subsequent result set. This could result in multiple raiserrors being returned on a single execute.

Default Buffer Size for Long Columns (in Kb): An integer value that specifies, in 1024-byte multiples, the maximum length of data fetched from a TEXT or IMAGE column. The default is 1,024 kilobytes. You will need to increase this value if the total size of any long data exceeds 1 megabyte.

Initialization String: Supports the running of Sybase commands at connect time. Multiple commands must be separated by semicolons.

Enable Quoted Identifiers: Allows support of quoted identifiers.

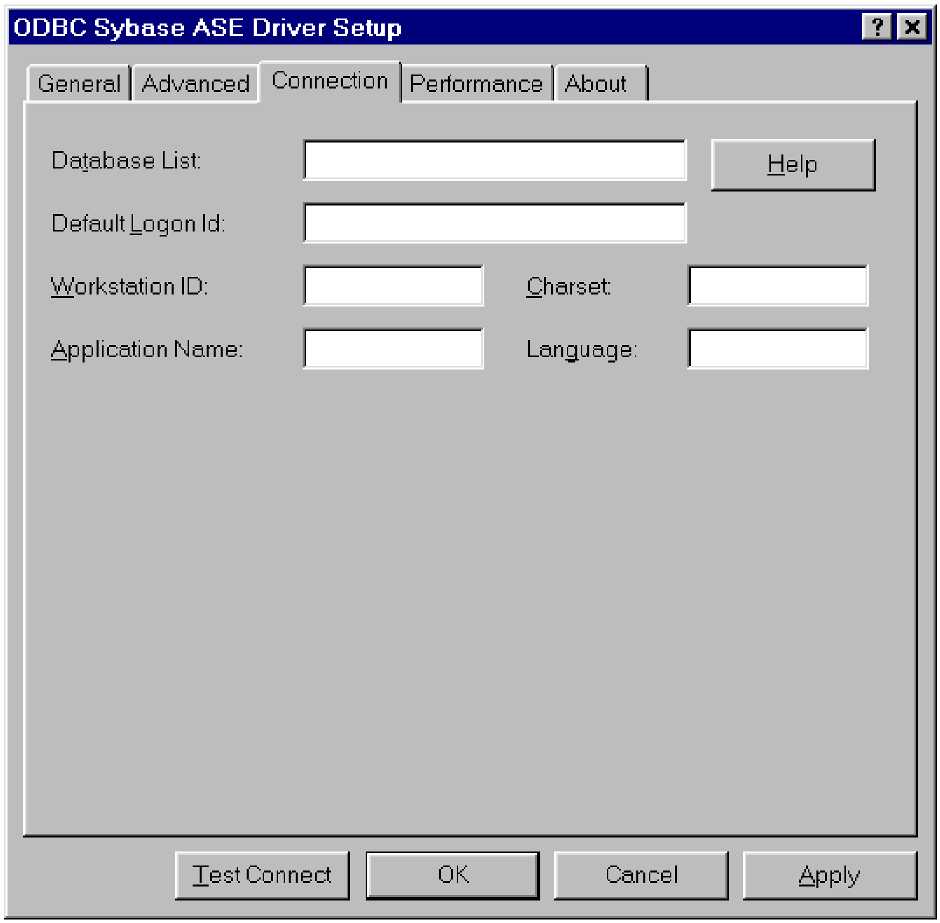
Enable Describe Parameter: Check this box to enable the SQLDescribeParam function, which allows an application to describe parameters in SQL statements and in stored procedure calls. To use this option, Prepare Method must be set to 0 or 1, and the SQL statement must not include long parameters. This option should be checked when using Microsoft Remote Data Objects (RDO) to access data.

Application Using Threads: Ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click the **Connection** tab to configure optional data source settings.



8 Specify values for the following; then, click **Apply.**

Database List: The databases that appear in the logon dialog box. Separate the names with commas.

Default Logon ID: The default logon ID used to connect to your Sybase database. This ID is case-sensitive. A logon ID is required only if security is enabled for the database you are connecting to. Your ODBC application may override this value or you can override this value in the logon dialog box or connection string.

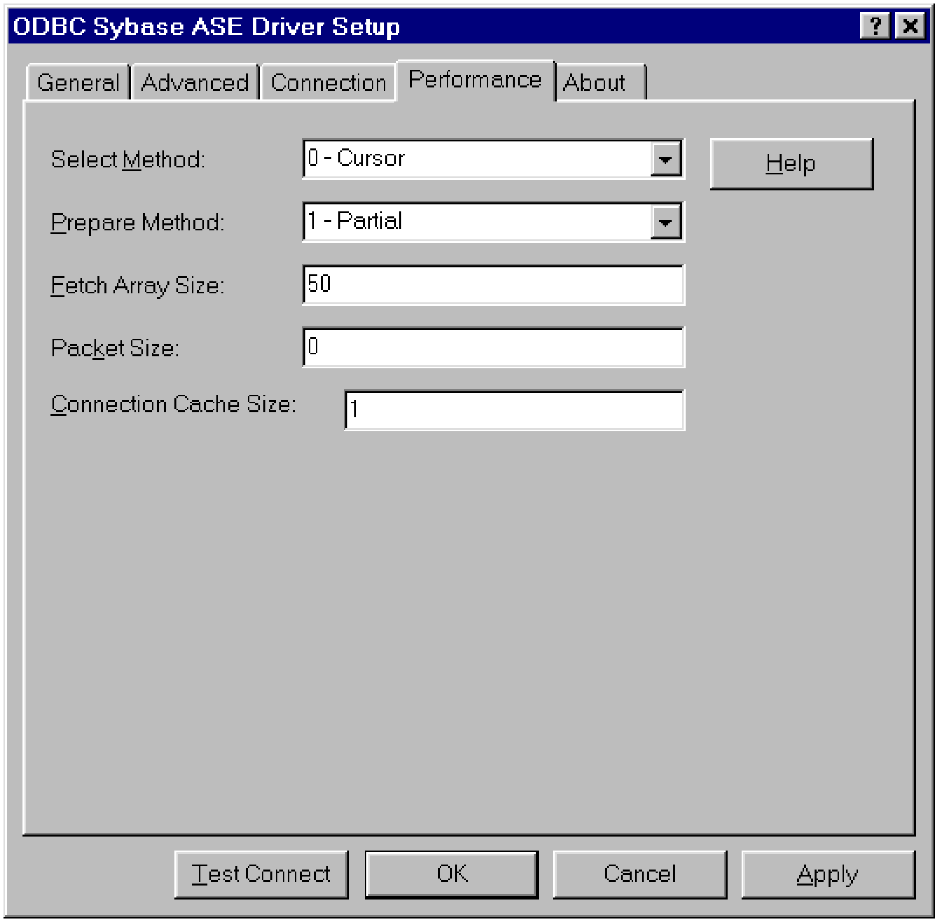
Workstation ID: The workstation ID used by the client.

Application Name: The name used by Sybase to identify your application.

Charset: The name of a character set. This character set must be installed on the Sybase server. The default is the setting on the Sybase server.

Language: The national language. This language must be installed on the Sybase server. The default is English.

9 Click the **Performance** tab to configure performance settings for this data source.



10 Specify values for the following; then, click **Apply.**

Select Method: A value of 0 or 1 that determines whether database cursors are used for Select statements. When set to 0, the default, database cursors are used; when set to 1, Select statements are run directly without using database cursors. A setting of 1 limits the data source to one active statement.

Prepare Method: A value of 0, 1, 2, or 3 that determines whether stored procedures are created on the server for calls to SQLPrepare.

When set to 0, stored procedures are created for every call to SQLPrepare. This setting can result in decreased performance when processing statements that do not contain parameters.

When set to 1 (the initial default), the driver creates stored procedures only if the statement contains parameters. Otherwise, the statement is cached and run directly at the time of SQLExecute.

When set to 2, stored procedures are never created. The driver caches the statement, executes it directly at the time of SQLExecute, and reports any syntax or similar errors at the time of SQLExecute.

When set to 3, stored procedures are never created. This is identical to value 2 except that any syntax or similar errors are returned at the time of SQLPrepare instead of SQLExecute. Use this setting only if you must have syntax errors reported at the time of SQLPrepare.

Fetch Array Size: The number of rows the driver retrieves when fetching from the server. This is not the number of rows given to the user. The default is 50 rows.

Packet Size: A value of -1, 0, or *x* that determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance.

When set to 0, the default, the driver uses the default packet size as specified in the Sybase server configuration.

When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information.

When set to *x*, an integer from 1 to 1024, the driver uses a packet size represented by *x* times 512 bytes. For example, "6" means to set the packet size to 6 * 512 bytes (3072 bytes).

To take advantage of this connection attribute, you must configure the Sybase server for a maximum network packet size greater than or equal to the value you specified for PacketSize. For example:

```
sp_configure "maximum network packet size", 5120
reconfigure
Restart Sybase Server
```

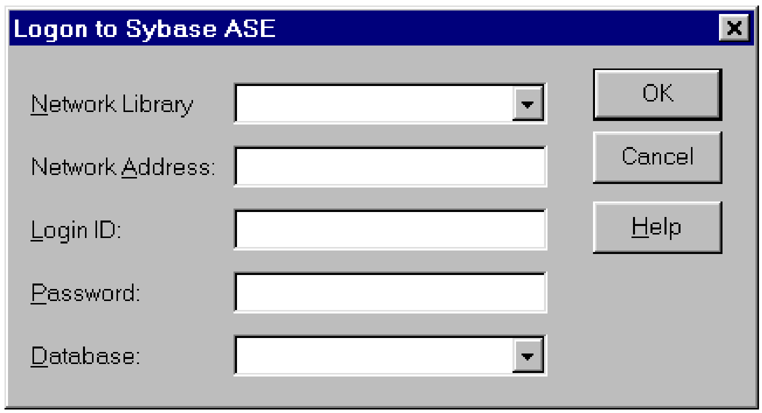
Note that the ODBC specification identifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, they have been defined as mutually exclusive. If PacketSize is specified, you will receive a message "Driver Not Capable" if you attempt to call SQL_PACKET_SIZE. If you do not set PacketSize, then application calls to SQL_PACKET_SIZE are accepted by the driver.

Connection Cache Size: A value that determines the number of connections that the connection cache can hold. The default Connection Cache setting is 1. To set the connection cache, you must set the Select Method option to 1 - Direct. Increasing the connection cache may increase performance of some applications but requires additional database resources.

11 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a Logon dialog box when you are connecting to a data source. In these cases, the data source name has already been specified. For Sybase ASE, the dialog box is as follows:



In this dialog box, do the following:

1 The name of the network library. This specifies which network protocol to use. The values are Winsock and NamedPipes.

2 The network address depends on which network protocol is chosen under Network Library Name and on the Sybase server. If you have chosen Winsock, specify an IP address as follows: "<servername or IP address>, <port number>". For example, if your network supports named servers, you may specify an address such as "Sybaseserver, 5000". You may also specify the IP address directly such as "199.226.224.34, 5000".

If you have chosen NamedPipes as the network protocol, you must specify the pipe address of the server. For example, "\\machine1\sybase\pipe\query".

3 If required, type your case-sensitive login ID.

4 If required, type your case-sensitive password for the system.

5 Type the name of the database you want to access (case-sensitive) or select the name from the Database drop-down list, which displays the names you specified in the ODBC Sybase ASE Driver Setup dialog box.

6 Click **OK** to complete the logon and to update the values in the system information.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute*=*value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for Sybase ASE is:

```
DSN=SYS10 TABLES;SRVR=QESRVR;DB=PAYROLL;UID=JOHN;PWD=XYZZY
```

Table 15-1 gives the long and short names for each attribute, as well as a description.

The defaults listed in the table are initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 15-1. Sybase ASE Connection String Attributes

Attribute	Description
ApplicationName (APP)	The name used by Sybase to identify your application.
ApplicationUsing Threads (AUT)	ApplicationUsingThreads={0 | 1}. Ensures that the driver works with multi-threaded applications. The default is 1, which makes the driver thread-safe. When using the driver with single-threaded applications, you may set this option to 0 to avoid additional processing required for ODBC thread safety standards.
ArraySize (AS)	The number of rows the driver retrieves from the server for a fetch. This is not the number of rows given to the user. This increases performance by reducing network traffic. The initial default is 50 rows.
Charset (CS)	The name of a character set. This character set must be installed on the Sybase server. The default is the setting on the Sybase server.
CursorCacheSize (CCS)	The number of connections that the connection cache can hold. The initial default value for CursorCacheSize is 1 (one cursor). To set the connection cache, you must set the SelectMethod attribute to 1. Increasing the connection cache may increase performance of some applications but requires additional database resources.
Database (DB)	The name of the database to which you want to connect.
DataSourceName (DSN)	A string that identifies a single connection to a Sybase database. Examples include "Accounting" or "Sys10-Serv1."

***Table 15-1. Sybase ASE Connection String Attributes** (cont.)*

Attribute	Description
DefaultLongData BuffLen (DLDBL)	An integer value that specifies, in 1024-byte multiples, the maximum length of data fetched from a TEXT or IMAGE column. The default is DefaultLongDataBuffLen=1024. You will need to increase this value if the total size of any long data exceeds 1 megabyte.
EnableDescribe Param (EDP)	EnableDescribeParam={0 | 1}. When set to 1, enables the ODBC API function SQLDescribeParam, which allows an application to describe parameters in SQL statements and in stored procedure calls. To use this option, OptimizePrepare must be set to 0 or 1, and the SQL statement must not include long parameters. This option should be set to 1 when using Microsoft Remote Data Objects (RDO) to access data. The default is 0.
EnableQuoted Identifiers (EQI)	EnableQuotedIdentifiers={0 | 1}. Specify 1 to allow support of quoted identifiers. The default is 0.
InitializationString (IS)	InitializationString={<Sybase set commands>;...}. Supports the execution of Sybase commands at connect time. Multiple commands must be separated by semicolons.
Language (LANG)	The national language. This language must be installed on the Sybase server. The default is English.
LogonID (UID)	The default logon ID used to connect to your Sybase database. This ID is case-sensitive. A logon ID is required only if security is enabled on your database. If so, contact your system administrator to get your logon ID.

Table 15-1. Sybase ASE Connection String Attributes (cont.)

Attribute	Description
NetworkAddress (NA)	The network address depends on which network protocol is chosen under Network Library Name and on the Sybase server. If you have chosen Winsock, specify an IP address as follows: "<servername or IP address>, <port number>". For example, if your network supports named servers, you may specify an address such as "Sybaseserver, 5000". You may also specify the IP address directly such as "199.226.224.34, 5000". If you have chosen NamedPipes as the network protocol, you must specify the pipe address of the server. For example "\\machine1\sybase\pipe\query".
NetworkLibrary Name (NLM)	The name of the network library. This specifies which network protocol to use. The values are Winsock and NamedPipes. The default is Winsock.

Table 15-1. Sybase ASE Connection String Attributes (cont.)

Attribute	Description
OptimizePrepare (OP)	OptimizePrepare={0 | 1 | 2 | 3}. This attribute determines whether stored procedures are created on the server for calls to SQLPrepare. When set to 0, stored procedures are created for every call to SQLPrepare. This setting can result in decreased performance when processing statements that do not contain parameters. When set to 1 (the initial default), the driver creates stored procedures only if the statement contains parameters. Otherwise, the statement is cached and run directly at the time of SQLExecute. When set to 2, stored procedures are never created. The driver caches the statement, executes it directly at the time of SQLExecute, and reports any syntax or similar errors at the time of SQLExecute. When set to 3, stored procedures are never created. This is identical to value 2 except that any syntax or similar errors are returned at the time of SQLPrepare instead of SQLExecute. Use this setting only if you must have syntax errors reported at the time of SQLPrepare.

Table 15-1. Sybase ASE Connection String Attributes (cont.)

Attribute	Description

PacketSize (PS)	PacketSize={-1 | 0 | *x*}. This attribute determines the number of bytes per network packet transferred from the database server to the client. The correct setting of this attribute can improve performance.
	When set to 0, the initial default, the driver uses the default packet size as specified in the Sybase server configuration.
	When set to -1, the driver computes the maximum allowable packet size on the first connect to the data source and saves the value in the system information.
	When set to x, an integer from 1 to 1024, the driver uses a packet size represented by x times 512 bytes. For example, PacketSize=6 means to set the packet size to 6 * 512 bytes (3072 bytes).
	To take advantage of this connection attribute, you must configure the Sybase server for a maximum network packet size greater than or equal to the value you specified for PacketSize. For example:
	`sp_configure "maximum network packet size", 5120`
	`reconfigure`
	`Restart Sybase Server`
	Note that the ODBC specification specifies a connect option, SQL_PACKET_SIZE, that offers this same functionality. To avoid conflicts with applications that may set both the connection string attribute and the ODBC connect option, they have been defined as mutually exclusive. If PacketSize is specified, you will receive a message "Driver Not Capable" if you attempt to call SQL_PACKET_SIZE. If you do not set PacketSize, then application calls to SQL_PACKET_SIZE are accepted by the driver.

Password (PWD)	A case-sensitive password.

***Table 15-1. Sybase ASE Connection String Attributes** (cont.)*

Attribute	Description
RaiseErrorPosition Behavior (REPB)	RaiseErrorPositionBehavior={0 | 1}. A value that specifies when the error is returned and where the cursor is positioned when raiserror is encountered. When set to 0 (the default), raiserror is handled separately from surrounding statements. The error is returned when raiserror is processed via SQLExecute, SQLExecDirect, or SQLMoreResults. The result set is empty. When set to 1 (MS compatible), raiserror is handled with the next statement. The error is returned when the next statement is processed; the cursor is positioned on the first row of subsequent result set. This could result in multiple raiserrors being returned on a single execute.
SelectMethod (SM)	SelectMethod={0 | 1}. This attribute determines whether database cursors are used for Select statements. When set to 0, the initial default, database cursors are used. In some cases performance degradation can occur when performing large numbers of sequential Select statements because of the amount of overhead associated with creating database cursors. When set to 1, Select statements are run directly without using database cursors. When set to 1, the data source is limited to one active statement.
WorkstationID (WKID)	The workstation ID used by the client.

Data Types

Table 15-2 shows how the Sybase ASE data types are mapped to the standard ODBC data types.

Table 15-2. Sybase ASE Data Types

Sybase	ODBC
binary	SQL_BINARY
bit	SQL_BIT
char	SQL_CHAR
datetime	SQL_TYPE_TIMESTAMP
decimal	SQL_DECIMAL
float	SQL_FLOAT
image	SQL_LONGVARBINARY
int	SQL_INTEGER
money	SQL_DECIMAL
numeric	SQL_NUMERIC
real	SQL_REAL
smalldatetime	SQL_TYPE_TIMESTAMP
smallint	SQL_SMALLINT
smallmoney	SQL_DECIMAL
sysname	SQL_VARCHAR
text	SQL_LONGVARCHAR
timestamp	SQL_VARBINARY
tinyint	SQL_TINYINT
varbinary	SQL_VARBINARY
varchar	SQL_VARCHAR

Isolation and Lock Levels Supported

Sybase ASE supports isolation levels 0 (read uncommitted), 1 (read committed, the default), 2 (repeatable read), and 3 (serializable). It supports page-level locking. See Appendix D, "Locking and Isolation Levels," on page 423 for details.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Sybase ASE driver. In addition, the following functions are supported:

- SQLColumnPrivileges
- SQLForeignKeys
- SQLPrimaryKeys
- SQLProcedureColumns
- SQLProcedures
- SQLTablePrivileges

The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

The Sybase database system supports multiple connections and multiple statements per connection. If SelectMethod=1, Sybase data sources are limited to one active statement in manual commit mode.

16 Connect ODBC for Text

Connect ODBC for Text (the "Text driver") supports ASCII text files in the Windows 9*x*, Windows NT, and UNIX environments. These files can be printed directly or edited with text editors or word processors, because none of the data is stored in a binary format.

See the README file shipped with your DataDirect product for the file name of the text driver.

System Requirements

The Text driver executes SQL statements directly on the text files. The driver supports Insert statements and inserts the record at the end of the file. You can execute Update and Delete statements conditionally.

Formats for Text Files

Some common formats for text files are listed in Table 16-1.

Table 16-1. Common Text File Formats

Format	Description
Comma-separated values	Commas separate column values, and each line is a separate record. Column values can vary in length. These files often have the .CSV extension.
Tab-separated values	Tabs separate column values, and each line is a separate record. Column values can vary in length.
Character-separated values	Any printable character except single or double quotation marks can separate column values, and each line is a separate record. Column values can vary in length.
Fixed	No character separates column values. Instead, values start at the same position and have the same length in each line. The values appear in fixed columns if you display the file. Each line is a separate record.
Stream	No character separates column values nor records. The table is one long stream of bytes.

Comma-, tab-, and character-separated files are called character-delimited files because values are separated by a special character.

Configuring Data Sources

Under Windows, data sources are configured and modified through the ODBC Administrator.

UNIX

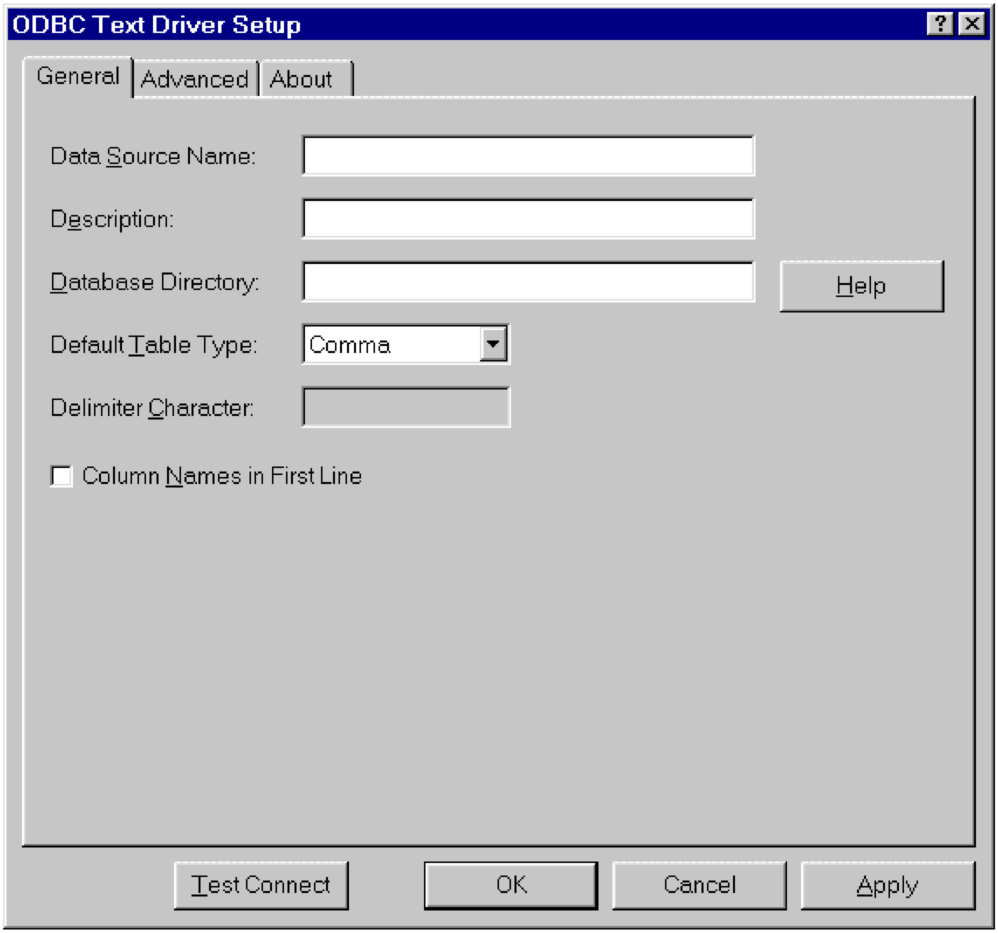
Note: In the UNIX environment, there is no ODBC Administrator. To configure a data source in the UNIX environment, you must edit the system information file using the attributes in Table 16-4 on page 354. You must also edit this file to perform a translation. See Appendix H, "The UNIX Environment," on page 457 for information about editing the file.

To configure a Text data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the ODBC Text Driver Setup dialog box.

   If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the Text driver and click **Finish** to display the ODBC Text Driver Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Driver Setup dialog box.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this Text data source configuration in the system information. Examples include "Accounting" or "Text Files."

Description: An optional long description of a data source name. For example, "My Accounting Files" or "My Text Files in the Accounting Directory."

Database Directory: The directory in which the text files are stored. If none is specified, the current working directory is used.

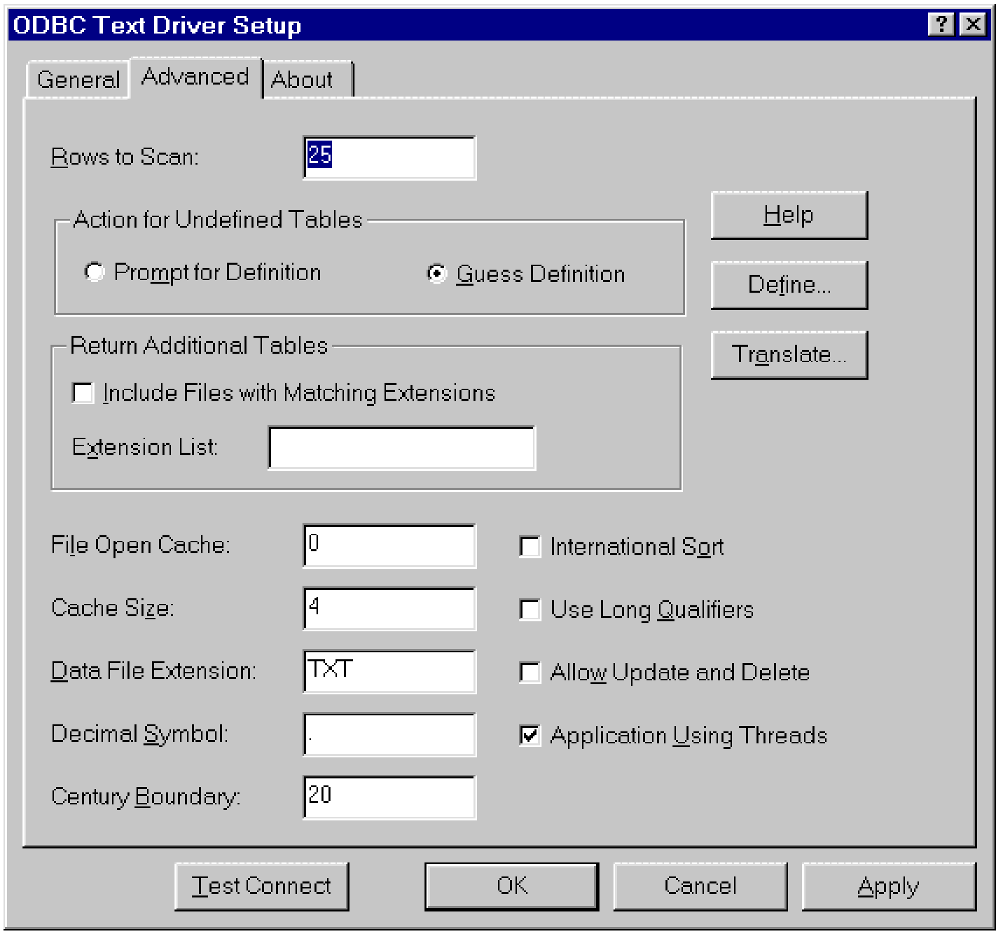
Default Table Type: The type of text file: comma-separated, tab-separated, character-separated, fixed length, or stream. This value tells the driver the default type, which is used when creating a new table and opening an undefined table.

Delimiter Character: The character used as a delimiter for character-separated files. It can be any printable character. The default is a comma (,).

Column Names in First Line: Select this check box to tell the driver to look for column names in the first line of the file.

Note: The Default Table Type, Delimiter Character, and Column Names in First Line settings apply only to tables not previously defined. These fields also determine the attributes of new tables created with the Create Table statement.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply.**

Rows to Scan: The number of rows in a text file that the driver scans to determine the data types in the file. If the value is 0, all rows in the file are scanned. The default is 25.

Action for Undefined Tables: Two radio buttons that indicate what action the driver should take when it encounters a file that has not been defined. Select the Prompt for Definition radio button, if you want the driver to prompt the user when it encounters a file whose format is not defined. Otherwise, select the Guess Definition radio button; in this case, the driver guesses the file's format.

Return Additional Tables: Select this check box to tell the driver to return files with a given extension in addition to the files specified in the Data File Extension field. In Extension List, specify a comma-separated list of the extensions. To have files with no extensions returned, specify NONE. For example, if some of your files have the extensions TXT and CSV and others have no extension, specify TXT,CSV,NONE.

By default, when an application requests a list of tables, only files that have been defined are returned.

File Open Cache: An integer value that specifies the maximum number of unused file opens to cache. For example, the value 4 specifies that when a user opens and closes four tables, the tables are not actually closed. The driver keeps them open so that if another query uses one of these tables, the driver does not have to perform another open, which is expensive. The advantage of file open caching is increased performance. The disadvantage is that a user who specifies file locking on open may get a locking conflict even though no one appears to have the file open. The default is 0, which means no file open caching.

Cache Size: The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The default is 4.

Data File Extension: Specifies the file extension to use for data files. The default Data File Extension setting is TXT. The Data File Extension setting cannot be greater than three characters. The Data File Extension setting is used for all Create Table statements. Sending a Create Table using an extension other than the Data File Extension setting causes an error.

In other SQL statements, such as Select or Insert, users can specify an extension other than the Data File Extension setting. The Data File Extension setting is used when no extension is specified.

Decimal Symbol: A setting that specifies the decimal separator used when data is stored (may be a comma or period). The international decimal symbol (.) must be used in DML statements and parameter buffers.

Century Boundary: Century Boundary specifies the cutoff year for century inference when converting two-digit dates to four-digit dates. Two-digit dates that are less than the specified year number will be converted to 20xx. Two-digit dates greater than or equal to the number will be converted to 19xx. The default value is 20. For example, using the default value, a date of 19 will be interpreted as 2019 and a date of 21 will be interpreted as 1921.

International Sort: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

Use Long Qualifiers (Windows only): Select this check box to use long path names as table qualifiers. When you select this check box, path names can be up to 255 characters. The default length for pathnames is 128 characters.

Allow Update and Delete: Specifies whether a data source allows Update and Delete statements. The default is 0. Because Update and Delete statements cause immediate changes to a table, only one connection at a time can operate on a table. When this option is set, tables are opened exclusively by the current connection. Each update and delete on a text file can cause significant changes to the file, and performance may be poor. Consider a more appropriate database form if performance is a significant factor.

Application Using Threads: A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Define: Click **Define** to define the structure of your text files as described in "Defining Table Structure" on page 344.

Translate: Click **Translate** to display the Select Translator dialog box, which lists the translators specified in the ODBC Translators section of the system information. DataDirect provides a translator named "OEM to ANSI" that translates your data from the IBM PC character set to the ANSI character set.

Select a translator; then, click **OK** to close this dialog box and perform the translation.

7 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

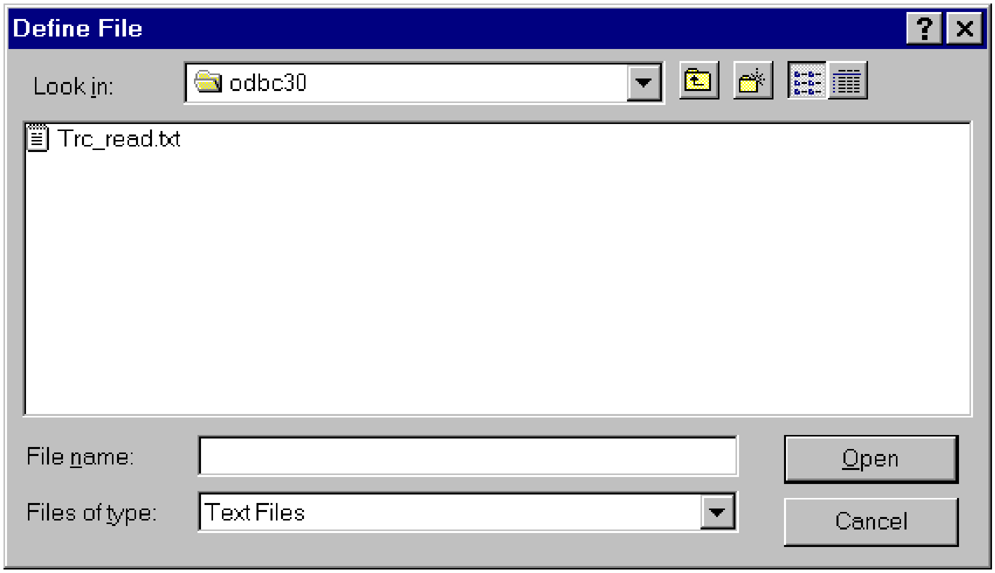
Defining Table Structure

Note that this section does not apply to the UNIX platforms. See "Defining Table Structure on UNIX Platforms" on page 349 for information on how to define table structure on the UNIX platforms.

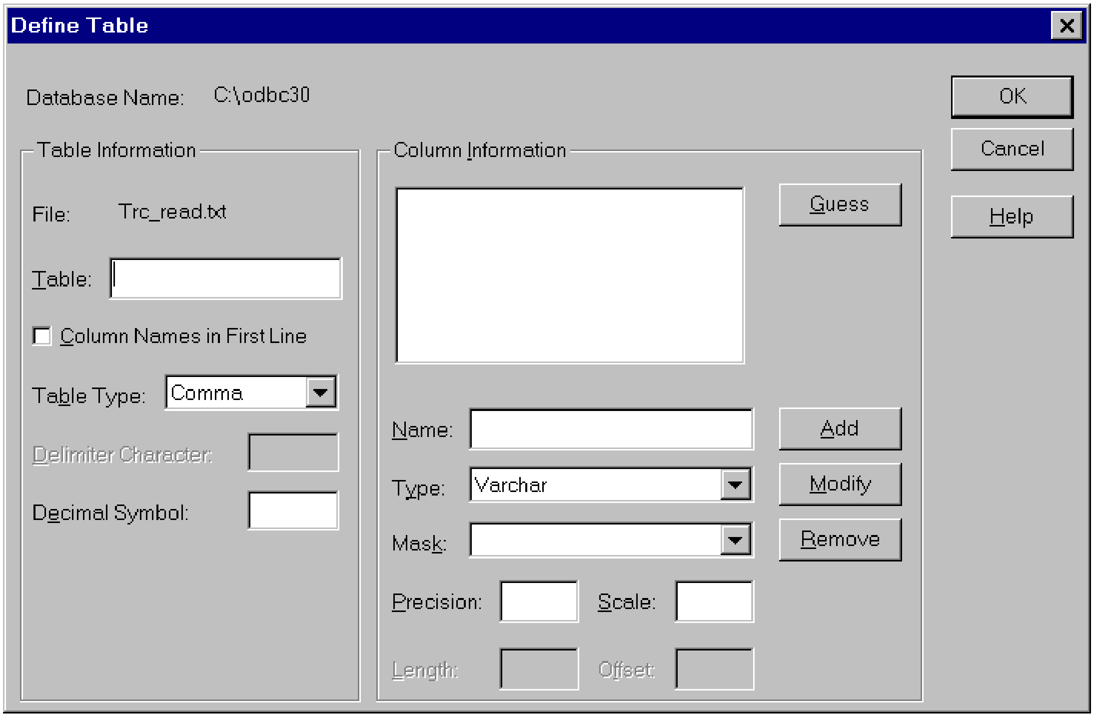
Because text files do not all have the same structure, the driver provides the option of defining the structure of an existing file. Although defining the structure is not mandatory (the driver can attempt to guess the names and types of the columns), this feature is extremely useful.

Define the structure of a file as follows:

1 Display the ODBC Text Driver Setup dialog box through the ODBC Administrator. Click the **Advanced** tab; then, click **Define** to display the Define File dialog box.



2 Select the correct file and click **Open** to display the Define Table dialog box.



Database Name: The name of the database directory that you selected in the Define File dialog box.

File: The name of the file that you selected in the Define File dialog box.

Table: Type a table name in the Table box. The name may be up to 32 characters in length and must be unique. This name is returned by SQLTables. By default, it is the file name without its extension.

Column Names in First Line: Select this check box if the first line of the file contains column names; otherwise, do not select this box.

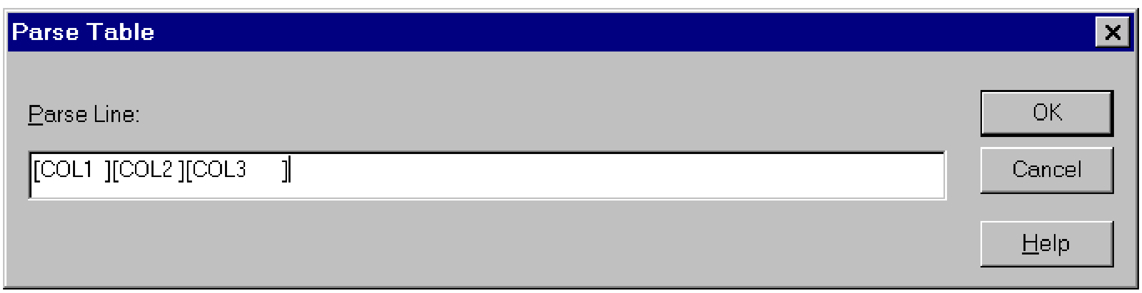
Table Type: Select either comma, tab, fixed, character, or stream.

Delimiter Character: If the table type is Character, specify the delimiter used in character-separated files.

Decimal Symbol: Type a comma to store the data using a comma as the separator for decimal numbers.

3 If you specified a *comma-separated*, *tab-separated*, or *character-separated* type in the Table Type field, the **Guess** button is active and you can click it to have the driver guess at the column names and display them in the list box of the Column Information pane.

If you specified a *fixed-length* or *stream* type in the Table Type field, the **Parse** button is active and you can click it to display the Parse Table dialog box and define the table columns.



This dialog box displays the first line of the file. You must mark where *each* field begins and ends by enclosing it in brackets. These brackets indicate the position and length of each field value in the record. Click **OK** to close the Parse Table dialog box. The driver will suggest column names in the list box of the Column Information pane.

4 If you do not want the driver to guess or parse, enter values in the following fields to define each column. Click **Add** to add the column name to the list box.

   Name: Type the name of the column.

   Type: Select the data type of the column. If the field type is Date, you must select a date mask for the field or type one in. See "Date Masks" on page 351 for more information.

   Precision: Type the precision of the column. The precision of numeric data types is defined as the maximum number of digits used by the data type of the column. For character types, this is the length in characters of the data; for binary data types, precision is defined as the length in bytes of the data. For time, timestamp, and all interval data types, precision is the number of characters in the character representation of this data. Note that the precision and scale values determine how numeric data is to be returned.

   Scale: Type the scale of the column. The scale of decimal and numeric data types is defined as the maximum number of digits to the right of the decimal point. For approximate floating point number columns, the scale is undefined, since the number of digits to the right of the decimal point is not fixed. For datetime or interval data that contains a seconds component, the scale is defined as the number of digits to the right of the decimal point in the seconds component of the data. Note that the precision and scale values determine how numeric data is to be returned.

   Length: If you specified a fixed-length table type, length is the number of bytes the data takes up in storage.

   Offset: If you specified a fixed-length table type, offset is the number of bytes from the start of the table to the start of the field.

5 To modify an existing column definition, select the column name in the list box. Modify the values for that column name; then, click **Modify**.

6 To delete an existing column definition, select a column name in the list box and click **Remove**.

7 Click **OK** to define the table.

Defining Table Structure on UNIX Platforms

UNIX

Because text files do not all have the same structure, the driver provides the option to define the structure of an existing file. Although defining the structure is not mandatory, because the driver can attempt to guess the names and types of the columns, this feature is extremely useful.

To define the structure of a text file, you create a QETXT.INI file using any plain text editor, such as vi. The filename must be in uppercase. All of the tables you wish to define are specified in the QETXT.INI file. When you specify table attributes in QETXT.INI, you override the attributes specified in system information or in the connection string.

Define the QETXT.INI file as follows:

1 Create a [Defined Tables] section and list all of the tables you are defining. Specify the text filename (in either upper- or lowercase, depending on the file) followed by the name you want to give the table, for example:

```
emptxt.txt=EMP
```

Table names can be up to 32 characters in length and cannot be the same as another defined table in the database. This name is returned by SQLTables. By default, it is the filename without its extension.

2 For each table listed in the [Defined Tables] section, you must specify the text file (FILE=), the table type (TT=), whether the first line of the file contains column names (FLN=), and the delimiter character (DC=).

Specify the text filename. For example:

```
FILE=emptxt.txt
```

To define the table type, specify how the fields are separated (comma, tab, fixed, or character). For example:

```
TT=COMMA
```

If the table type is CHARACTER, specify the delimiter character. For example, if the fields are separated by semicolons:

```
DC=;
```

Specify whether the first line of the file contains column names, using 1 for yes and 0 for no. For example:

```
FLN=0
```

3 Define the fields in the table, beginning with FIELD1. For each field, specify the field name, field type, precision, scale, length, offset (for fixed tables), and date/time mask. See "Date Masks" on page 351 for information about masks.

Separate the values with commas. For example, to define two fields:

```
FIELD1=EMP_ID,VARCHAR,6,0,6,0,
FIELD2=HIRE_DATE,DATE,10,0,10,0,m/d/yy
```

4 Save the file as QETXT.INI. The driver looks for this file in the directory specified by the "Database" attribute in odbc.ini, or in the current directory.

Example of QETXT.INI

The following is an example of a QETXT.INI file. This file defines the structure of the emptext.txt file, which is a sample data file shipped with the DataDirect ODBC Text file.

```
[Defined Tables]
emptext.txt=EMP

[EMP]
FILE=emptext.txt
FLN=1
TT=Comma
Charset=ANSI
FIELD1=FIRST_NAME,VARCHAR,10,0,10,0,
FIELD2=LAST_NAME,VARCHAR,9,0,9,0,
FIELD3=EMP_ID,VARCHAR,6,0,6,0,
FIELD4=HIRE_DATE,DATE,10,0,10,0,m/d/yy
FIELD5=SALARY,NUMERIC,8,2,8,0,
FIELD6=DEPT,VARCHAR,4,0,4,0,
FIELD7=EXEMPT,VARCHAR,6,0,6,0,
FIELD8=INTERESTS,VARCHAR,136,0,136,0,
```

Date Masks

Date masks tell the driver how a date is stored in a text file. When a value is inserted into a text file, the date is formatted so that it matches the mask. When reading a text file, the driver converts the formatted date into a date data type.

Table 16-2 lists the symbols to use when specifying the date mask.

Table 16-2. Date Masks for Text Driver

Symbol	Description
m	Output the month's number (1–12).
mm	Output a leading zero if the month number is less than 10.
mmm, Mmm, MMM	Output the three-letter abbreviation for the month depending on the case of the Ms (that is, jan, Jan, JAN).
mmmm, Mmmm, MMMM	Output the full month name depending on the case of the Ms (that is, january, January, JANUARY).
d	Output the day number (1–31).
dd	Output a leading zero if the day number is less than 10.
ddd, Ddd, DDD	Output the three-letter day abbreviation depending on the case of the Ds (that is, mon, Mon, MON).
dddd, Dddd, DDDD	Output the day depending on the case of the Ds (that is, monday, Monday, MONDAY).
yy	Output the last two digits of the year.
yyyy	Output the full four digits of the year.
J	Output the Julian value for the date. The Julian value is the number of days since 4712 BC.
\ - . : , (space)	Special characters used to separate the parts of a date.
\	Output the next character. For example, if the mask is mm/dd/yyyy \A\D, the value appears as 10/01/1993 AD in the text file.
"string", 'string'	Output the string in the text file.

Table 16-3 shows some example date values, masks, and how the date appears in the text file.

Table 16-3. Date Mask Examples

Date	Mask	Value
1993-10-01	yyyy-mm-dd	1993-10-01
	m/d/yy	10/1/93
	Ddd, Mmm dd, yyyy	Fri, Oct 01, 1993

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

You can specify either long or short names in the connection string. The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for text files is:

```
DSN=TEXT FILES;TT=CHARACTER;DC=&
```

Table 16-4 gives the long and short names for each attribute, as well as a description.

UNIX

To configure a data source in the UNIX environment, you must edit the system information file. This file accepts only long names for attributes. See Appendix H, "The UNIX Environment," on page 457 for information about this file.

Table 16-4 also lists the initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 16-4. Text Connection String Attributes

Attribute	Description
AllowUpdateAndDelete (AUD)	AllowUpdateAndDelete={0 | 1}. Specifies whether a data source allows Update and Delete statements. The default is 0. Because Update and Delete statements cause immediate changes to a table, only one connection at a time can operate on a table. When this option is set, tables are opened exclusively by the current connection. Each update and delete on a text file can cause significant changes to the file, and performance may be poor. Consider a more appropriate database form if performance is a significant factor.
ApplicationUsingThreads (AUT)	ApplicationUsingThreads={0 | 1}. A setting that ensures that the driver works with multi-threaded applications. You can clear this check box when using the driver with single-threaded applications. Turning off this setting avoids additional processing required for ODBC thread safety standards.

Note: The ScanRows, TableType, Delimiter, FirstLineNames, and Charset attributes apply to tables that have *not* been defined. These attributes also determine the characteristics of new tables created with the Create Table statement.

Table 16-4. Text Connection String Attributes (cont.)

Attribute	Description
CacheSize (CSZ)	The number of 64 KB blocks the driver uses to cache database records. The greater the number of blocks, the better the performance. The maximum number of blocks you can set depends on the system memory available. If the cache size is greater than 0, when browsing backwards, you will not be able to see updates made by other users until you run the Select statement again. The initial default is 4.
CenturyBoundary (CB)	CenturyBoundary=20. Century Boundary specifies the cutoff year for century inference when converting two-digit dates to four-digit dates. Two-digit dates that are less than the specified year number will be converted to 20xx. Two-digit dates greater than or equal to the number will be converted to 19xx. The default value is 20. For example, using the default value, a date of 19 will be interpreted as 2019 and a date of 21 will be interpreted as 1921.
Database (DB)	The directory in which the text files are stored.
DataFileExtension (DFE)	Specifies the file extension to use for data files. The default Data File Extension setting is TXT. The Data File Extension setting cannot be greater than three characters. The Data File Extension setting is used for all Create Table statements. Sending a Create Table using an extension other than the Data File Extension setting causes an error. In other SQL statements, such as Select or Insert, users can specify an extension other than the Data File Extension setting. The Data File Extension setting is used when no extension is specified.

Note: The ScanRows, TableType, Delimiter, FirstLineNames, and Charset attributes apply to tables that have *not* been defined. These attributes also determine the characteristics of new tables created with the Create Table statement.

Table 16-4. Text Connection String Attributes (cont.)

Attribute	Description
DataSourceName (DSN)	A string that identifies a Text data source configuration in the system information. Examples include "Accounting" or "Text Files."
DecimalSymbol (DS)	DecimalSymbol={. | ,}. Specifies the decimal separator used when data is stored. The international decimal symbol (.) must be used in DML statements and parameter buffers.
Delimiter (DC)	The character used as a delimiter for character-separated files. It can be any printable character except single or double quotes. The initial default is a comma (,).
ExtraExtensions (EE)	A list of additional filename extensions to be recognized as text tables. When an application requests a list of tables, only files that have been defined are returned. To have the driver also return names of undefined files, specify a comma-separated list of file extensions. To specify files with no extension, use the keyword `None`.
FileOpenCache (FOC)	The maximum number of unused file opens to cache. For example, when FileOpenCache=4, and a user opens and closes four files, the files are not actually closed. The driver keeps them open so that if another query uses one of these files, the driver does not have to perform another open, which is expensive. The advantage of using file open caching is increased performance. The disadvantage is that a user who tries to open the file exclusively may get a locking conflict even though no one appears to have the file open. The initial default is 0.

Note: The ScanRows, TableType, Delimiter, FirstLineNames, and Charset attributes apply to tables that have *not* been defined. These attributes also determine the characteristics of new tables created with the Create Table statement.

Table 16-4. Text Connection String Attributes *(cont.)*

Attribute	Description
FirstLineNames (FLN)	FirstLineNames={0 | 1}. This attribute determines whether the driver looks for column names in the first line of the file. If FirstLineNames=1, the driver looks for column names in the first line of the file. If FirstLineNames=0 (the initial default), the first line is interpreted as the first record in the file.
IntlSort (IS)	IntlSort={0 | 1}. This attribute determines the order that records are retrieved when you issue a Select statement with an Order By clause. If IntlSort=0 (the initial default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If IntlSort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.
ScanRows (SR)	The number of rows in a text file that the driver scans to determine the column types in the file. If the value is 0, all rows in the file are scanned. The initial default is 25.
TableType (TT)	TableType={Comma | Tab | Character | Fixed | Stream}. The Text driver supports five types: comma-separated, tab-separated, character-separated, fixed length, and stream. Setting this value tells the driver the default type, which is used when creating a new table and opening an undefined table.

Note: The ScanRows, TableType, Delimiter, FirstLineNames, and Charset attributes apply to tables that have *not* been defined. These attributes also determine the characteristics of new tables created with the Create Table statement.

Table 16-4. Text Connection String Attributes *(cont.)*

Attribute	**Description**
UndefinedTable (UT)	The Text driver can perform two operations when it encounters a file that has not been defined. UndefinedTable=Prompt tells the driver to display a dialog box that allows the user to describe the file's format. UndefinedTable=Guess tells the driver to guess the file's format. This is the initial default.
UseLongQualifiers (ULQ)	UseLongQualifiers={0 | 1}. It specifies whether the driver uses long pathnames as table qualifiers. The default is 0, do not use long path names (the default length of path names is 128 characters). If UseLongQualifiers=1, the driver uses long path names (up to 255 characters).

Note: The ScanRows, TableType, Delimiter, FirstLineNames, and Charset attributes apply to tables that have *not* been defined. These attributes also determine the characteristics of new tables created with the Create Table statement.

Data Types

Table 16-5 shows how the text file data types are mapped to the standard ODBC data types.

Table 16-5. Text Data Types

Text	**ODBC**
Numeric	SQL_NUMERIC
Date	SQL_TYPE_DATE
Varchar	SQL_VARCHAR

Select Statement

You use the SQL Select statement to specify the columns and records to be read. All Select statement clauses described in Appendix A, "SQL for Flat-File Drivers," on page 377 are supported by the driver.

Alter Table Statement

The Text driver supports the Alter Table statement to add one or more columns to a table or to delete (drop) a single column.

The Alter Table statement has the form:

```
ALTER TABLE table_name {ADD column_name data_type |
ADD(column_name data_type [, column_name data_type]. . . ) |
DROP[COLUMN] column_name}
```

table_name is the name of the table to which you are adding or dropping columns.

column_name assigns a name to the column you are adding or specifies the column you are dropping.

data_type specifies the native data type of each column you add.

For example, to add two columns to the emp table:

```
ALTER TABLE emp (ADD startdate date, dept varchar(10))
```

You cannot add columns and drop columns in a single statement, and you can drop only one column at a time. For example, to drop a column:

```
ALTER TABLE emp DROP startdate
```

The Alter Table statement fails when you attempt to drop a column upon which other objects, such as indexes or views, are dependent.

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the Text driver. In addition, the following function is supported: SQLSetPos.

The Text driver also supports backward and random fetching in SQLExtendedFetch and SQLFetchScroll. The driver supports the minimum SQL grammar.

Number of Connections and Statements Supported

Text files support multiple connections and multiple statements per connection.

17 Connect ODBC for XML

Connect ODBC for XML (the "XML driver") supports XML files in the Windows 9*x* and Windows NT environments.

See the README file shipped with your DataDirect product for the file name of the XML driver.

System Requirements

To have access to embedded Internet Explorer 5 Data Islands, you must use Internet Explorer 5. You can use an earlier browser version; however, you will not have access to embedded Internet Explorer 5 Data Islands.

Terminology

Connect for XML uses some terms differently than other drivers and databases. The following table identifies some of these differences.

Catalog	File system directory or URL.
Row	The <row> element in an ADO 2.5 persisted XML file or its equivalent in a Data Island.

Schema	The XML driver recognizes the use of a document schema. A document schema can specify the set of allowable elements, their sequence, relationship to each other, and their cardinality. Connect for XML does not use the term in the context of "logging on to a user ID."
Table	Set of sibling elements, each with the same set of child elements or attributes. A table is XML rectangular markup. This could be XML Data Islands or ADO 2.5 persisted XML files.

Formats for XML Files

Some common formats for XML files are listed in Table 17-1.

Table 17-1. Common XML File Formats

Format	Description

ADO 2.5 persisted files	These are identified by a unique schema namespace URL. Although ADO uses the same data types defined by XML-Data, the data types use extensions, such as adding a maximum column width for string columns. ADO 2.5 persisted files are identified by the following unique XML element:
	`<xml xmlns:s="uuid:BDC6E3F0-6DA3-11d1-A2A3-00AA00C14882"`
	`xmlns:dt="uuid:C2F41010-65B3-11d1-A29F-00AA00C14882"`
	`xmlns:rs="urn:schemas-microsoft-com:rowset"`
	`xmlns:z="#RowsetSchema">`

Table 17-1. Common XML File Formats *(cont.)*

Format	Description
Microsoft Data Islands	These are identified by the <XML> tag in an HTML document. The Data Island can be embedded in the HTML document. Data Islands can include the following Schema definition and namespace: `<Schema xmlns="urn:schemas-microsoft-com:xml-data" xmlns:dt="urn:schemas-microsoft-com:datatypes">`
Any XML file	XML files can be specified with a path name or a URL. Within the XML file, the first element encountered is considered the "table." Child elements of this node are considered the "rows." Child elements of the row nodes are considered "columns." In the absence of a schema, all data is returned as DBTYPE_STRING.

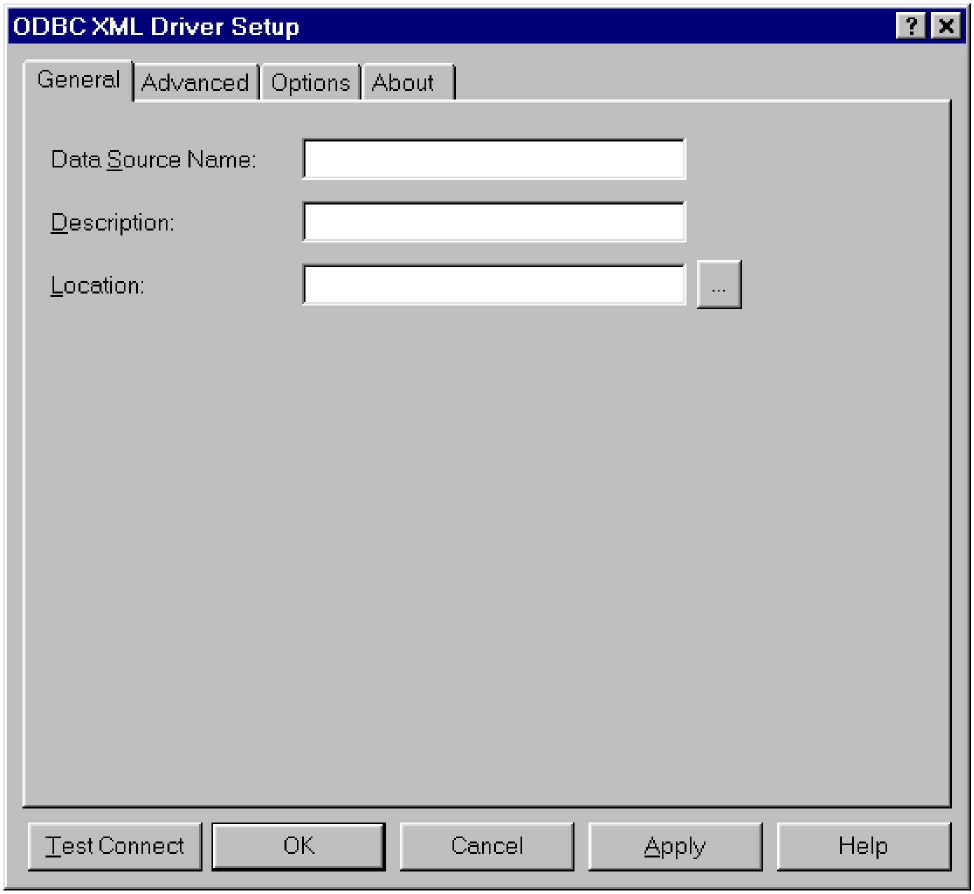
Configuring Data Sources

To configure an XML data source:

1 Start the ODBC Administrator to display a list of data sources.

2 If you are configuring an existing data source, select the data source name and click **Configure** to display the DataDirect Connect for XML Setup dialog box.

If you are configuring a new data source, click **Add** to display a list of installed drivers. Select the XML driver and click **Finish** to display the DataDirect Connect for XML Setup dialog box.



3 At any point during the configuration process, you can click **Test Connect** to attempt to connect to the data source using the connection properties specified in the Setup window.

- If the driver can connect, it releases the connection and displays a "connection established" message. Click **OK**.
- If the driver cannot connect because of an improper environment or incorrect connection value, it will display an appropriate error message. Click **OK**.

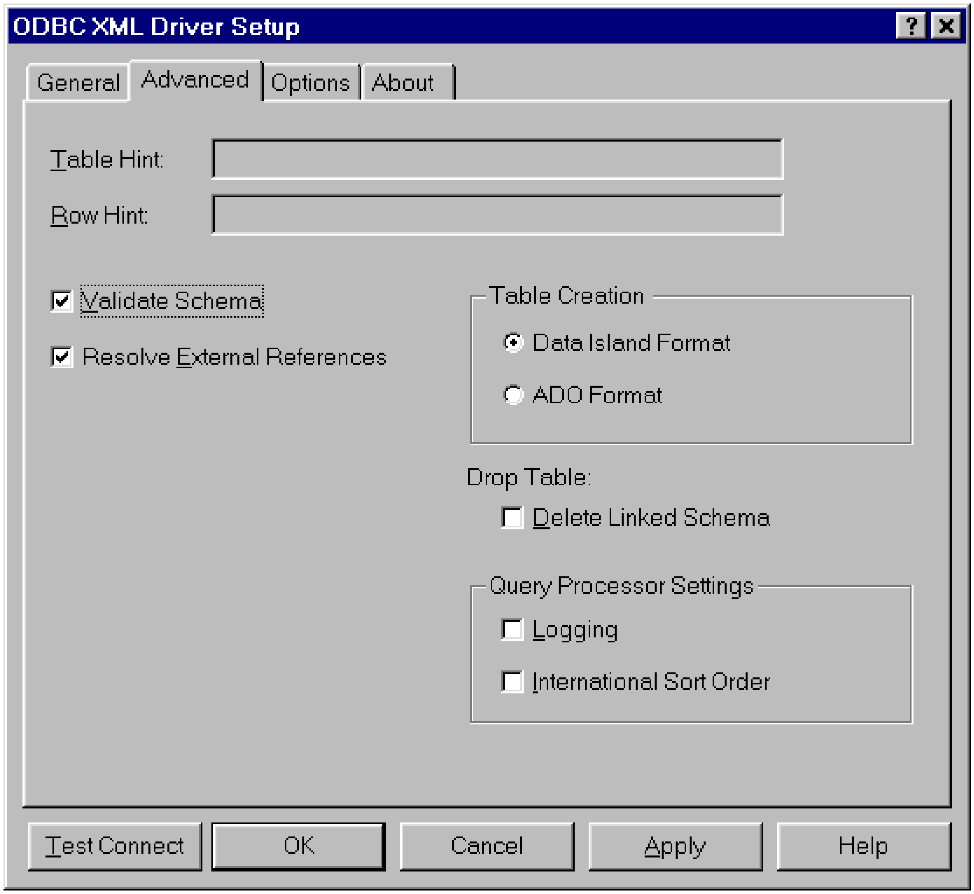
4 Specify values for the following; then, click **Apply.**

Data Source Name: A string that identifies this XML data source configuration in the system information. Examples include "Accounting" or "XML Files."

Description: An optional long description of a data source name. For example, "My Accounting Files" or "My XML Files in the Accounting Directory."

Location: Type a directory or URL that contains the XML files. To browse for the directory, click the button next to the Location field to open the Find Directory window. After you have located the directory, select any file within the directory and click **Open**. Even though you are choosing a directory and not a specific file, you must select a file before you can close the Find Directory window by clicking **Open**.

5 Click the **Advanced** tab to configure additional, optional settings for the data source.



6 Specify values for the following; then, click **Apply**.

Table Hint: A string that specifies an XSL pattern to identify the table or rowset nodes in an XML file.

Row Hint: A string that specifies an XSL pattern to identify the nodes that make up the rows in the rowset.

Validate Schema: This check box enables the validation of the XML file against its schema. By default, this check box is selected. To process an XML document even if the document is not valid, clear the check box.

Resolve External References: This check box enables the resolution of external references, such as DTDs, Schemas, Entities, and Notations. By default, this check box is selected. Clearing this box allows the document to be processed, even if the XML parser cannot locate the external references.

Table Creation: These radio buttons determine the style of XML that is generated when a new table is created. By default, Data Island Format is selected.

- **Data Island Format**: This button causes new tables to be generated with the IE 5 Data Island XML style.
- **ADO Format**: This button causes new tables to be generated with the ADO 2.5 XML style.

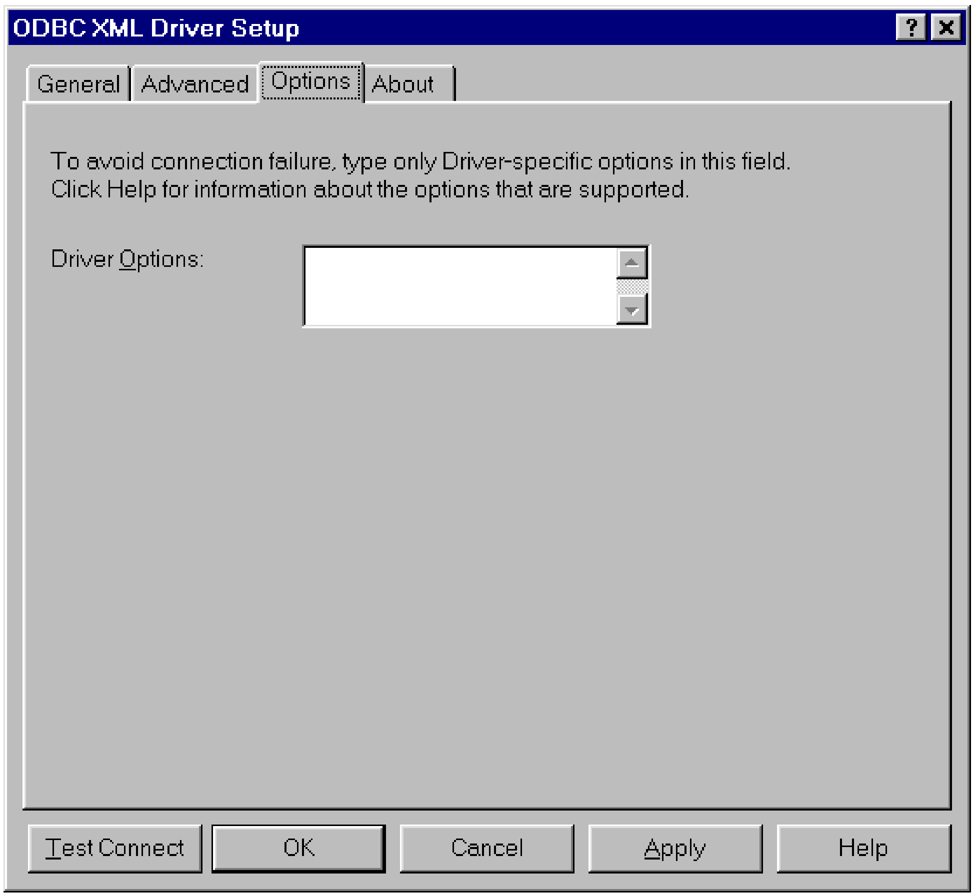
Delete Linked Schema: This check box specifies whether externally linked schema files are deleted when a table is deleted. The XML file for the table contains a link to this external schema file. If multiple XML files are linked to the same schema file, the schema file should not be deleted when a table is deleted. By default, this check box is not selected.

Logging: This check box controls whether logging is enabled. The log file logs the SQL execution plan. By default, this check box is not selected. If you select the check box, a log file is created in the current directory. The default log file name is \Integrator.txt.

International Sort Order: A setting to indicate the order in which records are retrieved when you issue a Select statement with an Order By clause. Clear this box to use ASCII sort order (the default setting). This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b."

Select this box to use international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.

7 Click the **Options** tab to add optional connection values for this data source.



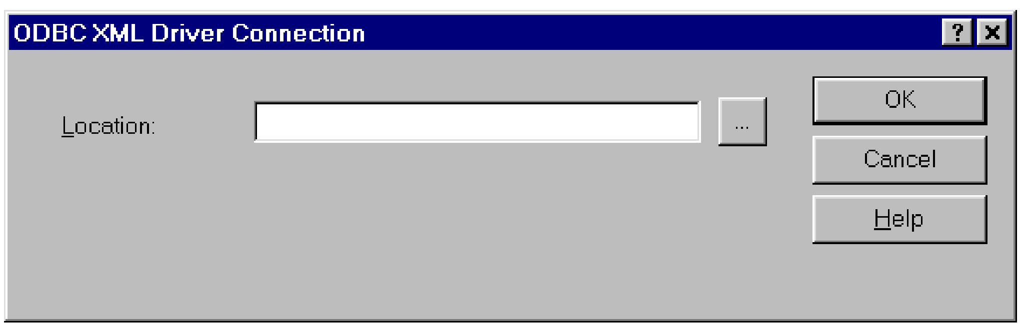
Driver Options: Use this field to add configuration options specific to the XML driver.

WARNING! The properties you set in the Options tab override other properties for this session only and can adversely affect the operation of the data provider. Use only authorized entries. For information about authorized entries for the Options tab, contact MERANT technical support.

8 Click **OK** or **Cancel**. If you click **OK**, the values you have specified become the defaults when you connect to the data source. You can change these defaults by using this procedure to reconfigure your data source. You can override these defaults by connecting to the data source using a connection string with alternate values.

Connecting to a Data Source Using a Logon Dialog Box

Some ODBC applications display a Logon dialog box when you are connecting to a data source. For XML, the dialog box is as follows:



In this dialog box, do the following:

1 Type the URL or directory location that contains the XML files into the entry field. UNC paths are supported.

To browse for the directory, click the button next to the Location field.

2 Click **OK** to connect to the data source.

Connecting to a Data Source Using a Connection String

If your application requires a connection string to connect to a data source, you must specify the data source name that tells the driver which section in the system information to use for the default connection information. Optionally, you may specify *attribute=value* pairs in the connection string to override the default values stored in the system information. These values are not written to the system information.

The connection string has the form:

```
DSN=data_source_name[;attribute=value[;attribute=value]...]
```

An example of a connection string for XML files is:

```
DSN=XML FILES;Create Type=ADO25
```

Table 17-2 gives the names and descriptions of the attributes. It also lists the initial defaults that apply when no value is specified in either the connection string or in the data source definition in the system information. If you specified a value for the attribute when configuring the data source, that value is the default.

Table 17-2. XML Connection String Attributes

Attribute	Description
Create Type	Create Type={IE5DataIsland | ADO25}. Determines the style of XML that is generated when a new table is created. The default is IE5DataIsland. New tables are generated with the Internet Explorer 5 Data Island XML style. Specify ADO25 to generate new tables with the ADO 2.5 XML style.
Delete Schema	Delete Schema={0 | 1}. Specifies whether externally linked schema files are deleted when a table is deleted. The XML file for the table contains a link to this external schema file. If multiple XML files are linked to the same schema file, the schema file should not be deleted when a table is deleted. The default is 0.
International Sort	International Sort={0 | 1}. Determines the order that records are retrieved when you issue a Select statement with an Order By clause. If International Sort=0 (the default), the driver uses the ASCII sort order. This order sorts items alphabetically with uppercase letters preceding lowercase letters. For example, "A, b, C" would be sorted as "A, C, b." If International Sort=1, the driver uses the international sort order as defined by your operating system. This order is always alphabetic, regardless of case; the letters from the previous example would be sorted as "A, b, C." See your operating system documentation concerning the sorting of accented characters.
Log Column Info	Log Column Info={0 | 1}. Enables logging of additional column information for each object in the resultset tree. The default value is 0.
Log Filename	Defines the name of the file in which logging will occur.

Table 17-2. XML Connection String Attributes (cont.)

Attribute	Description
Log Flush	Log Flush={0 | 1}. Specifies whether to flush logging information to disk frequently, ensuring that the most recent data is available. Enabling this property can significantly slow down the logging speed. The default value is 0.
Log Overwrite	Log Overwrite={0 | 1}. Specifies whether the log file is truncated during each session, overwriting any previous log information. The default value is 1. **Note**: Setting this value to 0 might cause the XML driver to generate extremely large log files.
Log Properties	Log Properties={0 | 1}. Enables logging of property information. Properties requested on the command, any properties that accompany calls to OpenRowset, and properties supported by the underlying provider's rowset objects are logged. The default value is 1.
Logging	Logging={0 | 1}. Enables internal logging. The amount of logging is controlled by other attributes that must be set in the connection string. The default value is 0. The default log file name is \Integrator.txt.
Max BLOB Compare Size	Specifies the number of bytes at the beginning of a BLOB when making comparisons in the XML driver's evaluator. If a BLOB is larger than specified length, it is truncated before comparison.
Max BLOB Sort Size	Specifies the number of bytes at the beginning of a BLOB that are used when performing an Order By, Distinct, or Group By on a BLOB column. This option can affect in-memory indexes that are built over BLOB columns during a join. The default value is 512. **Note**: Do not set the value higher than the default if the client application will use BLOBs as join condition columns.

Table 17-2. XML Connection String Attributes (cont.)

Attribute	Description
Mode	Mode={1 | 2 | 3}}. Specifies access permissions as follows: 1—is Read-only. 2—is Write-only. 3—is Read/write (the default).
Read Only	Read Only={0 | 1}. Determines whether to override the connection attribute to force a data source to be read-only.
Resolve External	Resolve External={0 | 1}. Enables the resolution of external references, such as DTDs, Schemas, Entities, and Notations. The default is 1. The value 0 allows the document to be processed, even if the XML parser cannot locate the external references.
Row Hint	This string specifies an XSL pattern to identify the nodes that make up the rows in the rowset.
Table Hint	This string specifies an XSL pattern to identify the table or rowset nodes in an XML file.
Use Floating Point Rounding	Use Floating Point Rounding={0 | 1}. Specifies whether the XML evaluator performs a small amount of rounding when comparing floating-point numbers. The binary representation of two identical floating-point numbers can be slightly different. When enabled, the evaluator compensates for this when comparing floating-point numbers. The default value is 0.
Validate Schema	Validate Schema={0 | 1}. Enables the validation of the XML file against its schema. The default is 0. This allows a well-formed XML document to be processed, even if the document is not valid.
XML.Initial Catalog	This attribute specifies the name of an initial directory or URL that contains XML or HTML files. When defined, schema rowsets look in this location to find tables.

Data Types

Table 17-3 shows how the XML file data types are mapped to the standard ODBC data types.

Table 17-3. XML Data Types

XML	ODBC
Binhex	SQL_LONGVARBINARY
Boolean	SQL_BIT
Currency	SQL_DECIMAL
Date	SQL_TYPE_DATE
Datetime	SQL_TYPE_TIMESTAMP
Float	SQL_DOUBLE
i1	SQL_TINYINT
i2	SQL_SMALLINT
i4	SQL_INTEGER
Int	SQL_INTEGER
Number	SQL_DOUBLE
r4	SQL_REAL
r8	SQL_DOUBLE
Singlechar	SQL_SMALLINT
Time	SQL_TYPE_TIME
ui1	SQL_TINYINT
ui2	SQL_SMALLINT
ui4	SQL_INTEGER
Wchar	SQL_CHAR
Wlvarchar	SQL_LONGVARCHAR
Wvarchar	SQL_VARCHAR

ODBC Conformance Level

See Appendix C, "ODBC API and Scalar Functions," on page 411 for a list of the API functions supported by the XML driver. In addition, the following function is supported: SQLSetPos.

Number of Connections and Statements Supported

There is no limit to the number of connections and statements supported.

A SQL for Flat-File Drivers

This appendix describes the SQL statements that you can use with the flat-file drivers (Btrieve, dBASE, Excel, Paradox, and Text). The database drivers parse SQL statements and translate them into a form that the database can understand. The SQL statements in this appendix let you:

- Read, insert, update, and delete records from a database
- Create new tables
- Drop existing tables

These SQL statements allow your application to be portable across other databases.

Select Statement

The form of the Select statement supported by the flat-file drivers is

```
SELECT [DISTINCT] {* | column_expression, ...}
FROM table_names [table_alias] ...
[ WHERE expr1 rel_operator expr2 ]
[ GROUP BY {column_expression, ...} ]
[ HAVING expr1 rel_operator expr2 ]
[ UNION [ALL] (SELECT...) ]
[ ORDER BY {sort_expression [DESC | ASC]}, ... ]
[ FOR UPDATE [OF {column_expression, ...}] ]
```

Select Clause

Follow Select with a list of column expressions you want to retrieve or an asterisk (*) to retrieve all fields.

```
SELECT [DISTINCT] {* | column_expression, [[AS]
column_alias]. . .}
```

column_expression can be simply a field name (for example, LAST_NAME). More complex expressions may include mathematical operations or string manipulation (for example, SALARY * 1.05). See "SQL Expressions" on page 384 for details.

column_alias can be used to give the column a more descriptive name. For example, to assign the alias DEPARTMENT to the column DEP:

```
SELECT dep AS department FROM emp
```

Separate multiple column expressions with commas (for example, LAST_NAME, FIRST_NAME, HIRE_DATE).

Field names can be prefixed with the table name or alias. For example, EMP.LAST_NAME or E.LAST_NAME, where E is the alias for the table EMP.

The Distinct operator can precede the first column expression. This operator eliminates duplicate rows from the result of a query. For example:

```
SELECT DISTINCT dep FROM emp
```

Aggregate Functions

Aggregate functions can also be a part of a Select clause. Aggregate functions return a single value from a set of records. An aggregate can be used with a field name (for example, AVG(SALARY)) or in combination with a more complex column expression (for example, AVG(SALARY * 1.07)). The column expression can be preceded by the Distinct operator. The Distinct operator eliminates duplicate values from an aggregate expression. For example:

```
COUNT (DISTINCT last_name)
```

In this example, only distinct last name values are counted.

Table A-1 lists valid aggregates.

Table A-1. Aggregate Functions

Aggregate	Returns
SUM	The total of the values in a numeric field expression. For example, SUM(SALARY) returns the sum of all salary field values.
AVG	The average of the values in a numeric field expression. For example, AVG(SALARY) returns the average of all salary field values.
COUNT	The number of values in any field expression. For example, COUNT(NAME) returns the number of name values. When using COUNT with a field name, COUNT returns the number of non-null field values. A special example is COUNT(*), which returns the number of records in the set, including records with null values.
MAX	The maximum value in any field expression. For example, MAX(SALARY) returns the maximum salary field value.
MIN	The minimum value in any field expression. For example, MIN(SALARY) returns the minimum salary field value.

From Clause

The From clause indicates the tables that will be used in the Select statement. The format of the From clause is

```
FROM table_names [table_alias]
```

table_names can be one or more simple table names in the current working directory or complete pathnames.

table_alias is a name used to refer to this table in the rest of the Select statement. Database field names may be prefixed by the table alias. Given the table specification

```
FROM emp E
```

you may refer to the LAST_NAME field as E.LAST_NAME. Table aliases must be used if the Select statement joins a table to itself. For example:

```
SELECT * FROM emp E, emp F WHERE E.mgr_id = F.emp_id
```

The equal sign (=) includes only matching rows in the results.

If you are joining more than one table, you can use LEFT OUTER JOIN, which includes nonmatching rows in the first table you name. For example:

```
SELECT * FROM T1 LEFT OUTER JOIN T2 on T1.key = T2.key
```

Where Clause

The Where clause specifies the conditions that records must meet to be retrieved. The Where clause contains conditions in the form:

```
WHERE expr1 rel_operator expr2
```

expr1 and *expr2* may be field names, constant values, or expressions.

rel_operator is the relational operator that links the two expressions. See "SQL Expressions" on page 384 for details.

For example, the following Select statement retrieves the names of employees that make at least $20,000.

```
SELECT last_name,first_name FROM emp WHERE salary >= 20000
```

Group By Clause

The Group By clause specifies the names of one or more fields by which the returned values should be grouped. This clause is used to return a set of aggregate values. It has the following form:

GROUP BY *column_expressions*

column_expressions must match the column expression used in the Select clause. A column expression can be one or more field names of the database table, separated by a comma (,) or one or more expressions, separated by a comma (,). See "SQL Expressions" on page 384 for details.

The following example sums the salaries in each department:

```
SELECT dept_id, sum(salary) FROM emp GROUP BY dept_id
```

This statement returns one row for each distinct department ID. Each row contains the department ID and the sum of the salaries of the employees in the department.

Having Clause

The Having clause enables you to specify conditions for groups of records (for example, display only the departments that have salaries totaling more than $200,000). This clause is valid only if you have already defined a Group By clause. It has the following form:

```
HAVING expr1 rel_operator expr2
```

expr1 and *expr2* can be field names, constant values, or expressions. These expressions do not have to match a column expression in the Select clause.

rel_operator is the relational operator that links the two expressions. See the section "SQL Expressions" later in this appendix.

The following example returns only the departments whose sums of salaries are greater than $200,000:

```
SELECT dept_id, sum(salary) FROM emp
GROUP BY dept_id HAVING sum(salary) > 200000
```

Union Operator

The Union operator combines the results of two Select statements into a single result. The single result is all of the returned records from both Select statements. By default, duplicate records are not returned. To return duplicate records, use the All keyword (UNION ALL). The form is

```
SELECT statement
UNION [ALL]
SELECT statement
```

When using the Union operator, the select lists for each Select statement must have the same number of column expressions with the same data types and must be specified in the same order. For example:

```
SELECT last_name, salary, hire_date FROM emp
UNION
SELECT name, pay, birth_date FROM person
```

This example has the same number of column expressions, and each column expression, in order, has the same data type.

The following example is *not* valid because the data types of the column expressions are different (SALARY from EMP has a different data type than LAST_NAME from RAISES). This example does have the same number of column expressions in each Select statement but the expressions are not in the same order by data type.

```
SELECT last_name, salary FROM emp
UNION
SELECT salary, last_name FROM raises
```

Order By Clause

The Order By clause indicates how the records are to be sorted. The form is

```
ORDER BY {sort_expression [DESC | ASC]}, ...
```

sort_expression can be field names, expressions, or the positional number of the column expression to use.

The default is to perform an ascending (ASC) sort.

For example, to sort by LAST_NAME then by FIRST_NAME you could use either of the following Select statements:

```
SELECT emp_id, last_name, first_name FROM emp
ORDER BY last_name, first_name
```

or

```
SELECT emp_id, last_name, first_name FROM emp
ORDER BY 2,3
```

In the second example, LAST_NAME is the second column expression following Select, so Order By 2 sorts by LAST_NAME.

For Update Clause

The For Update clause locks the records of the database table selected by the Select statement. The form is

```
FOR UPDATE OF column_expressions
```

column_expressions is a list of field names in the database table that you intend to update, separated by a comma (,).

The following example returns all records in the employee database that have a SALARY field value of more than $20,000. When each record is fetched, it is locked. If the record is updated or deleted, the lock is held until you commit the change. Otherwise, the lock is released when you fetch the next record.

```
SELECT * FROM emp WHERE salary > 20000
   FOR UPDATE OF last_name, first_name, salary
```

SQL Expressions

Expressions are used in the Where clauses, Having clauses, and Order By clauses of SQL Select statements.

Expressions enable you to use mathematical operations as well as character string and date manipulation operators to form complex database queries.

The most common expression is a simple field name. You can combine a field name with other expression elements.

Valid expression elements are as follows:

- Field names
- Constants
- Exponential notation
- Numeric operators
- Character operators
- Date operators
- Relational operators
- Logical operators
- Functions

Constants

Constants are values that do not change. For example, in the expression PRICE * 1.05, the value 1.05 is a constant.

You must enclose character constants in pairs of single (') or double quotation marks ("). To include a single quotation mark in a character constant enclosed by single quotation marks, use two single quotation marks together (for example, 'Don''t'). Similarly, if the constant is enclosed by double quotation marks, use two double quotation marks to include one.

You must enclose date and time constants in braces ({}), for example, {01/30/89} and {12:35:10}. The form for date constants is MM/DD/YY or MM/DD/YYYY. The form for time constants is HH:MM:SS.

The logical constants are .T. and 1 for True and .F. and 0 for False. For portability, use 1 and 0.

Exponential Notation

You may include exponential notation. For example:

```
SELECT col1, 3.4E+7 FROM table1 WHERE calc < 3.4E-6 * col2
```

Numeric Operators

You may include the following operators in numeric expressions:

Operator	Meaning
+	Addition
–	Subtraction
*	Multiplication
/	Division
**	Exponentiation
^	Exponentiation

The following table shows examples of numeric expressions. For these examples, assume SALARY is 20000.

Example	Resulting value
`salary + 10000`	`30000`
`salary * 1.1`	`22000`
`2 ** 3`	`8`

You can precede numeric expressions with a unary plus (+) or minus (–). For example, `–(salary * 1.1)` is -22000.

Character Operators

Character expressions may include the following operators:

Operator	Meaning
+	Concatenation keeping trailing blanks.
–	Concatenation moving trailing blanks to the end.

The following chart shows examples of character expressions. In the examples, LAST_NAME is `'JONES   '` and FIRST_NAME is `'ROBERT  '`.

Example	Resulting value
`first_name + last_name`	`'ROBERT    JONES  '`
`first_name – last_name`	`'ROBERTJONES      '`

Note: Some flat-file drivers return character data with trailing blanks as shown in the table; however, you cannot rely on the driver to return blanks. Therefore, if you want an expression that works with drivers that do and do not return trailing blanks, use the TRIM function before concatenating strings to make the expression portable. For example:

```
TRIM(first_name) + '' + TRIM(last_name)
```

Date Operators

You may include the following operators in date expressions:

Operator	Meaning
+	Add a number of days to a date to produce a new date.
–	The number of days between two dates, or subtract a number of days from a date to produce a new date.

The following chart shows examples of date expressions. In these examples, hire_date is {01/30/90}.

Example	Resulting value
`hire_date + 5`	`{02/04/90}`
`hire_date – {01/01/90}`	`29`
`hire_date – 10`	`{01/20/90}`

Relational Operators

The relational operators separating the two expressions may be any one of those listed in Table A-2.

Table A-2. Relational Operators

Operator	Meaning
=	Equal.
<>	Not Equal.
>	Greater Than.
>=	Greater Than or Equal.
<	Less Than.
<=	Less Than or Equal.
Like	Matching a pattern.
Not Like	Not matching a pattern.

Table A-2. Relational Operators *(cont.)*

Operator	Meaning
Is Null	Equal to Null.
Is Not Null	Not Equal to Null.
Between	Range of values between a lower and upper bound.
In	A member of a set of specified values or a member of a subquery.
Exists	True if a subquery returned at least one record.
Any	Compares a value to each value returned by a subquery. Any must be prefaced by =, <>, >, >=, <, or <=. =Any is equivalent to In.
All	Compares a value to each value returned by a subquery. All must be prefaced by =, <>, >, >=, <, or <=.

The following list shows some examples of relational operators:

```
salary <= 40000
dept = 'D101'
hire_date > {01/30/89}
salary + commission >= 50000
last_name LIKE 'Jo%'
salary IS NULL
salary BETWEEN 10000 AND 20000
WHERE salary = ANY (SELECT salary FROM emp WHERE dept = 'D101')
WHERE salary > ALL (SELECT salary FROM emp WHEREdept = 'D101')
```

Logical Operators

Two or more conditions may be combined to form more complex criteria. When two or more conditions are present, they must be related by AND or OR. For example:

```
salary = 40000 AND exempt = 1
```

The logical NOT operator is used to reverse the meaning. For example:

```
NOT (salary = 40000 AND exempt = 1)
```

Operator Precedence

As expressions become more complex, the order in which the expressions are evaluated becomes important. Table A-3 shows the order in which the operators are evaluated. The operators in the first line are evaluated first, then those in the second line, and so on. Operators in the same line are evaluated left to right in the expression.

Table A-3. Operator Precedence

Precedence	Operator
1	Unary -, Unary +
2	**
3	*, /
4	+, -
5	=, <>, <, <=, >, >=, Like, Not Like, Is Null, Is Not Null, Between, In, Exists, Any, All
6	Not
7	AND
8	OR

The following example shows the importance of precedence:

```
WHERE salary > 40000 OR
hire_date > {01/30/89} AND
dept = 'D101'
```

Because AND is evaluated first, this query retrieves employees in department D101 hired after January 30, 1989, as well as every employee making more than $40,000, no matter what department or hire date.

To force the clause to be evaluated in a different order, use parentheses to enclose the conditions to be evaluated first. For example:

```
WHERE (salary > 40000 OR hire_date > {01/30/89})
AND dept = 'D101'
```

retrieves employees in department D101 that either make more than $40,000 or were hired after January 30, 1989.

Functions

The flat-file drivers support a number of functions that you may use in expressions. In Table A-4 through Table A-6, the functions are grouped according to the type of result they return.

Table A-4. Functions that Return Character Strings

Function	Description
CHR	Converts an ASCII code into a one-character string. `CHR(67)` returns C.
RTRIM	Removes trailing blanks from a string. `RTRIM('ABC   ')` returns ABC.
TRIM	Removes trailing blanks from a string. `TRIM('ABC   ')` returns ABC.
LTRIM	Removes leading blanks from a string. `LTRIM('  ABC')` returns ABC.

Table A-4. Functions that Return Character Strings *(cont.)*

Function	Description
UPPER	Changes each letter of a string to uppercase. `UPPER('Allen')` returns `ALLEN`.
LOWER	Changes each letter of a string to lowercase. `LOWER('Allen')` returns `allen`.
LEFT	Returns leftmost characters of a string. `LEFT('Mattson',3)` returns `Mat`.
RIGHT	Returns rightmost characters of a string. `RIGHT('Mattson',4)` returns `tson`.
SUBSTR	Returns a substring of a string. Parameters are the string, the first character to extract, and the number of characters to extract (optional). `SUBSTR('Conrad',2,3)` returns `onr`. `SUBSTR('Conrad',2)` returns `onrad`.
SPACE	Generates a string of blanks. `SPACE(5)` returns `'     '`.

DTOC	Converts a date to a character string. An optional second parameter determines the format of the result:
	0 (the default) returns MM/DD/YY
	1 returns DD/MM/YY
	2 returns YY/MM/DD
	10 returns MM/DD/YYYY
	11 returns DD/MM/YYYY
	12 returns YYYY/MM/DD
	An optional third parameter specifies the date separator character. If not specified, a slash (/) is used.
	`DTOC({01/30/97})` returns `01/30/97`
	`DTOC({01/30/97}, 0)` returns `01/30/97`
	`DTOC({01/30/97}, 1)` returns `30/01/97`
	`DTOC({01/30/97}, 2,'-')` returns `97-01-30`

Table A-4. Functions that Return Character Strings (cont.)

Function	Description
DTOS	Converts a date to a character string using the format YYYYMMDD. `DTOS({01/23/90})` returns `19900123`.
IIF	Returns one of two values. Parameters are a logical expression, the true value, and the false value. If the logical expression evaluates to True, the function returns the true value. Otherwise, it returns the false value. `IIF(salary>20000,'BIG','SMALL')` returns `BIG` if SALARY is greater than 20000. If not, it returns `SMALL`.

STR	Converts a number to a character string. Parameters are the number, the total number of output characters (including the decimal point), and optionally the number of digits to the right of the decimal point.
	`STR(12.34567,4)` returns `12`
	`STR(12.34567,4,1)` returns `12.3`
	`STR(12.34567,6,3)` returns `12.346`

STRVAL	Converts a value of any type to a character string.
	`STRVAL('Woltman')` returns `Woltman`
	`STRVAL({12/25/53})` returns `12/25/53`
	`STRVAL (5 * 3)` returns `15`
	`STRVAL (4 = 5)` returns `'False'`

TIME	Returns the time of day as a string. At 9:49 PM, `TIME()` returns `21:49:00`

Table A-4. Functions that Return Character Strings (cont.)

Function	Description
TTOC	**Note:** This function is applicable only for those flat-file drivers that support SQL_TIMESTAMP, the Btrieve, Excel 4, Excel 5, FoxPro 3.0, and Paradox 5 drivers. Converts a timestamp to a character string. An optional second parameter determines the format of the result: ■ 0 or none, the default, returns MM/DD/YY HH:MM:SS AM ■ 1 returns YYYYMMDDHHMMSS, which is a suitable format for indexing. TTOC({1992-04-02 03:27:41}) returns 04/02/92 03:27:41 AM. TTOC({1992-04-02 03:27:41, 1}) returns 19920402032741
USERNAME	For Btrieve, the logon ID specified at connect time is returned. For Paradox and Paradox 5 drivers, the user name specified during configuration is returned. For all other flat file drivers, an empty string is returned.

Table A-5. Functions that Return Numbers

Function	Description
MOD	Divides two numbers and returns the remainder of the division. `MOD(10,3)` returns 1
LEN	Returns the length of a string. `LEN('ABC')` returns 3
MONTH	Returns the month part of a date. `MONTH({01/30/89})` returns 1
DAY	Returns the day part of a date. `DAY({01/30/89})` returns 30
YEAR	Returns the year part of a date. `YEAR({01/30/89})` returns 1989

Table A-5. Functions that Return Numbers (cont.)

Function	Description
MAX	Returns the larger of two numbers. `MAX(66,89)` returns 89
DAYOFWEEK	Returns the day of week (1-7) of a date expression. `DAYOFWEEK({05/01/95})` returns 5.
MIN	Returns the smaller of two numbers. `MIN(66,89)` returns 66
POW	Raises a number to a power. `POW(7,2)` returns 49
INT	Returns the integer part of a number. `INT(6.4321)` returns 6

ROUND	Rounds a number.
	`ROUND(123.456, 0)` returns `123`
	`ROUND(123.456, 2)` returns `123.46`
	`ROUND(123.456, -2)` returns `100`

NUMVAL	Converts a character string to a number. If the character string is not a valid number, a zero is returned. `NUMVAL('123')` returns the number 123
VAL	Converts a character string to a number. If the character string is not a valid number, a zero is returned. `VAL('123')` returns the number 123

Table A-6. Functions that Return Dates

Function	Description
DATE	Returns today's date. If today is 12/25/79, `DATE()` returns `{12/25/79}`
TODAY	Returns today's date. If today is 12/25/79, `TODAY()` returns `{12/25/79}`

Table A-6. Functions that Return Dates *(cont.)*

Function	Description
DATEVAL	Converts a character string to a date. `DATEVAL('01/30/89')` returns `{01/30/89}`

CTOD	Converts a character string to a date. An optional second parameter specifies the format of the character string: 0 (the default) returns MM/DD/YY, 1 returns DD/MM/YY, and 2 returns YY/MM/DD.
	`CTOD('01/30/89')` returns `{01/30/89}`
	`CTOD('01/30/89',1)` returns `{30/01/89}`

The following examples use some of the number and date functions.

Retrieve all employees that have been with the company at least 90 days:

```
SELECT first_name, last_name FROM emp
   WHERE DATE() – hire_date >= 90
```

Retrieve all employees hired in January of this year or last year:

```
SELECT first_name, last_name FROM emp
   WHERE MONTH(hire_date) = 1
   AND (YEAR(hire_date) = YEAR(DATE())
   OR YEAR(hire_date) = YEAR(DATE()) – 1)
```

Create and Drop Table Statements

The flat-file drivers support SQL statements to create and delete database files. The Create Table statement is used to create files and the Drop Table statement is used to delete files.

Create Table

The form of the Create Table statement is

```
CREATE TABLE table_name (col_definition[,col_definition, ...])
```

table_name can be a simple table name or a full pathname. A simple table name is preferred for portability to other SQL data sources. If it is a simple table name, the file is created in the directory you specified as the database directory in the connection string. If you did not specify a database directory in the connection string, the file is created in the directory you specified as the database directory in .odbc.ini. If you did not specify a database directory in either place, the file is created in the current working directory at the time you connected to the driver.

col_definition is the column name, followed by the data type, followed by an optional column constraint definition. Values for column names are database specific. The data type specifies a column's data type.

The only column constraint definition currently supported by some flat-file drivers is "not null." Not all flat-file tables support "not null" columns. In the cases where not null is not supported, this restriction is ignored and the driver returns a warning if "not null" is specified for a column. The "not null" column constraint definition is allowed in the driver so that you can write a database-independent application (and not be concerned about the driver raising an error on a Create Table statement with a "not null" restriction).

A sample Create Table statement to create an employee database table is

```
CREATE TABLE emp (last_name CHAR(20) NOT NULL,
   first_name CHAR(12) NOT NULL,
   salary NUMERIC (10,2) NOT NULL,
   hire_date DATE NOT NULL)
```

Drop Table

The form of the Drop Table statement is

```
DROP TABLE table_name
```

table_name may be a simple table name (EMP) or a full pathname. A simple table name is preferred for portability to other SQL data sources. If it is a simple table name, the file is dropped from the directory you specified as the database directory in the connection string. If you did not specify a database directory in the connection string, the file is deleted from the directory you specified as the database directory in .odbc.ini. If you did not specify a database directory in either of these places, the file is dropped from the current working directory at the time you connected to the driver.

A sample Drop Table statement to delete the employee database table is

```
DROP TABLE emp
```

Insert Statement

The SQL Insert statement is used to add new records to a database table. With it, you can specify either of the following:

- A list of values to be inserted as a new record
- A Select statement that copies data from another table to be inserted as a set of new records

The form of the Insert statement is

```
INSERT INTO table_name [(col_name, ...)]
{VALUES (expr, ...) | select_statement}
```

table_name may be a simple table name or a full pathname. A simple table name is preferred for portability to other SQL data sources.

col_name is an optional list of column names giving the name and order of the columns whose values are specified in the Values clause. If you omit *col_name*, the value expressions (*expr*) must provide values for all columns defined in the file and must be in the same order that the columns are defined for the file.

expr is the list of expressions giving the values for the columns of the new record. Usually, the expressions are constant values for the columns. Character string values must be enclosed in single or double quotation marks, date values must be enclosed in braces {}, and logical values that are letters must be enclosed in periods (for example, .T. or .F.).

An example of an Insert statement that uses a list of expressions is

```
INSERT INTO emp (last_name, first_name, emp_id, salary, hire_date)
VALUES ('Smith', 'John', 'E22345', 27500, {4/6/91})
```

Each Insert statement adds one record to the database table. In this case a record has been added to the employee database table, EMP. Values are specified for five columns. The remaining columns in the table are assigned a blank value, meaning Null.

`select_statement` is a query that returns values for each `col_name` value specified in the column name list. Using a Select statement instead of a list of value expressions lets you select a set of rows from one table and insert it into another table using a single Insert statement.

An example of an Insert statement that uses a Select statement is

```
INSERT INTO emp1 (first_name, last_name, emp_id, dept, salary)
SELECT first_name, last_name, emp_id, dept, salary from emp
WHERE dept = 'D050'
```

In this type of Insert statement, the number of columns to be inserted must match the number of columns in the Select statement. The list of columns to be inserted must correspond to the columns in the Select statement just as it would to a list of value expressions in the other type of Insert statement. That is, the first column inserted corresponds to the first column selected; the second inserted to the second, etc.

The size and data type of these corresponding columns must be compatible. Each column in the Select list should have a data type that the ODBC driver accepts on a regular Insert/Update of the corresponding column in the Insert list. Values are truncated when the size of the value in the Select list column is greater than the size of the corresponding Insert list column.

The *select_statement* is evaluated before any values are inserted. This query cannot be made on the table into which values are inserted.

Update Statement

The SQL Update statement is used to change records in a database file. The form of the Update statement supported for flat-file drivers is

```
UPDATE table_name SET col_name = expr, ...
[ WHERE { conditions | CURRENT OF cursor_name } ]
```

table_name may be a simple table name or a full pathname. A simple table name is preferred for portability to other SQL data sources.

col_name is the name of a column whose value is to be changed. Several columns can be changed in one statement.

expr is the new value for the column. The expression can be a constant value or a subquery. Character string values must be enclosed with single or double quotation marks, date values must be enclosed by braces {}, and logical values that are letters must be enclosed by periods (for example, .T. or .F.). Subqueries must be enclosed in parentheses.

The Where clause (any valid clause described in "Select Statement" on page 377) determines which records are to be updated.

The Where Current Of *cursor_name* clause can be used only by developers coding directly to the ODBC API. It causes the row at which *cursor_name* is positioned to be updated. This is called a "positioned update." You must first execute a Select...For Update statement with a named cursor and fetch the row to be updated.

An example of an Update statement on the employee table is

```
UPDATE emp SET salary=32000, exempt=1
WHERE emp_id = 'E10001'
```

The Update statement changes every record that meets the conditions in the Where clause. In this case the salary and exempt status are changed for all employees having the employee ID E10001. Because employee IDs are unique in the employee table, only one record is updated.

An example using a subquery is

```
UPDATE emp SET salary = (SELECT avg(salary) from emp)
WHERE emp_id = 'E10001'
```

In this case, the salary is changed to the average salary in the company for the employee having employee ID E10001.

Delete Statement

The SQL Delete statement is used to delete records from a database table. The form of the Delete statement supported for flat-file drivers is

```
DELETE FROM table_name
[ WHERE { conditions | CURRENT OF cursor_name } ]
```

table_name may be a simple table name or a full pathname. A simple table name is preferred for portability to other SQL data sources.

The Where clause (any valid clause described in "Select Statement" on page 377) determines which records are to be deleted. If you include only the keyword Where, all records in the table are deleted but the file is left intact.

The Where Current Of *cursor_name* clause can be used only by developers coding directly to the ODBC API. It causes the row at which *cursor_name* is positioned to be deleted. This is called a "positioned delete." You must first execute a Select...For Update statement with a named cursor and fetch the row to be deleted.

An example of a Delete statement on the employee table is

```
DELETE FROM emp WHERE emp_id = 'E10001'
```

Each Delete statement removes every record that meets the conditions in the Where clause. In this case every record having the employee ID E10001 is deleted. Because employee IDs are unique in the employee table, at most one record is deleted.

Reserved Keywords

The following words are reserved for use in SQL statements. If they are used for file or column names in a database that you use, you must enclose them in quotation marks in any SQL statement where they appear as file or column names.

- ALL
- AND
- BETWEEN
- COMPUTE
- CROSS
- DISTINCT
- FOR
- FROM
- FULL
- GROUP
- HAVING
- INNER
- INTO
- LEFT
- LIKE
- NATURAL
- NOT
- NULL
- ON
- OPTIONS
- OR
- OR
- ORDER
- RIGHT
- UNION
- WHERE

B Using Indexes

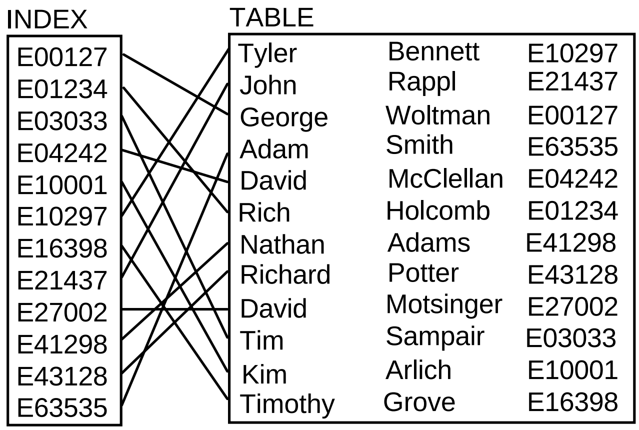
This appendix discusses the ways in which you can improve the performance of database activity using indexes. It provides general guidelines that apply to most databases. Consult your database vendor's documentation for more detailed information.

For information regarding how to create and drop indexes, see the appropriate database driver chapter for flat-file drivers or your database system documentation for relational drivers.

Introduction

An index is a database structure that you can use to improve the performance of database activity. A database table can have one or more indexes associated with it.

An index is defined by a field expression that you specify when you create the index. Typically, the field expression is a single field name, like EMP_ID. An index created on the EMP_ID field, for example, contains a sorted list of the employee ID values in the table. Each value in the list is accompanied by references to the records that contain that value.



A database driver can use indexes to find records quickly. An index on the EMP_ID field, for example, greatly reduces the time that the driver spends searching for a particular employee ID value. Consider the following Where clause:

```
WHERE emp_id = 'E10001'
```

Without an index, the driver must search the entire database table to find those records having an employee ID of E10001. By using an index on the EMP_ID field, however, the driver can quickly find those records.

Indexes may improve the performance of SQL statements. You may not notice this improvement with small tables but it can be significant for large tables; however, there can be disadvantages to having too many indexes. Indexes can slow down the performance of some inserts, updates, and deletes when the driver has to maintain the indexes as well as the database tables. Also, indexes take additional disk space.

Improving Record Selection Performance

For indexes to improve the performance of selections, the index expression must match the selection condition exactly. For example, if you have created an index whose expression is last_name, the following Select statement uses the index:

```
SELECT * FROM emp WHERE last_name = 'Smith'
```

This Select statement, however, does not use the index:

```
SELECT * FROM emp WHERE UPPER(last_name) = 'SMITH'
```

The second statement does not use the index because the Where clause contains UPPER(LAST_NAME), which does not match the index expression LAST_NAME. If you plan to use the UPPER function in all your Select statements and your database supports indexes on expressions, then you should define an index using the expression UPPER(LAST_NAME).

Indexing Multiple Fields

If you often use Where clauses that involve more than one field, you may want to build an index containing multiple fields. Consider the following Where clause:

```
WHERE last_name = 'Smith' and first_name = 'Thomas'
```

For this condition, the optimal index field expression is LAST_NAME, FIRST_NAME. This creates a concatenated index.

Concatenated indexes can also be used for Where clauses that contain only the first of two concatenated fields. The LAST_NAME, FIRST_NAME index also improves the performance of the following Where clause (even though no first name value is specified):

```
last_name = 'Smith'
```

Consider the following Where clause:

```
WHERE last_name = 'Smith' and middle_name =
'Edward' and first_name = 'Thomas'
```

If your index fields include all the conditions of the Where clause in that order, the driver can use the entire index. If, however, your index is on two nonconsecutive fields, say, LAST_NAME and FIRST_NAME, the driver can use only the LAST_NAME field of the index.

The driver uses only one index when processing Where clauses. If you have complex Where clauses that involve a number of conditions for different fields and have indexes on more than one field, the driver chooses an index to use. The driver attempts to use indexes on conditions that use the equal sign as the relational operator rather than conditions using other operators (such as greater than). Assume you have an index on the EMP_ID field as well as the LAST_NAME field and the following Where clause:

```
WHERE emp_id >= 'E10001' AND last_name = 'Smith'
```

In this case, the driver selects the index on the LAST_NAME field.

If no conditions have the equal sign, the driver first attempts to use an index on a condition that has a lower *and* upper bound, and then attempts to use an index on a condition that has a lower *or* upper bound. The driver always attempts to use the most restrictive index that satisfies the Where clause.

In most cases, the driver does not use an index if the Where clause contains an OR comparison operator. For example, the driver does not use an index for the following Where clause:

```
WHERE emp_id >= 'E10001' OR last_name = 'Smith'
```

Deciding Which Indexes to Create

Before you create indexes for a database table, consider how you will use the table. The two most common operations on a table are to

- Insert, update, and delete records
- Retrieve records

If you most often insert, update, and delete records, then the fewer indexes associated with the table, the better the performance. This is because the driver must maintain the indexes as well as the database tables, thus slowing down the performance of record inserts, updates, and deletes. It may be more efficient to drop all indexes before modifying a large number of records, and re-create the indexes after the modifications.

If you most often retrieve records, you must look further to define the criteria for retrieving records and create indexes to improve the performance of these retrievals. Assume you have an employee database table and you will retrieve records based on employee name, department, or hire date. You would create three indexes—one on the DEPT field, one on the HIRE_DATE field, and one on the LAST_NAME field. Or perhaps, for the retrievals based on the name field, you would want an index that concatenates the LAST_NAME and the FIRST_NAME fields (see "Indexing Multiple Fields" on page 405 for details).

Here are a few rules to help you decide which indexes to create:

- If your record retrievals are based on one field at a time (for example, dept='D101'), create an index on these fields.
- If your record retrievals are based on a combination of fields, look at the combinations.
- If the comparison operator for the conditions is AND (for example, CITY = 'Raleigh' AND STATE = 'NC'), then build a concatenated index on the CITY and STATE fields. This index is also useful for retrieving records based on the CITY field.
- If the comparison operator is OR (for example, DEPT = 'D101' OR HIRE_DATE > {01/30/89}), an index does not help performance. Therefore, you need not create one.
- If the retrieval conditions contain both AND and OR comparison operators, you can use an index if the OR conditions are grouped. For example:

  ```
  dept = 'D101' AND (hire_date > {01/30/89} OR
  exempt = 1)
  ```

  In this case, an index on the DEPT field improves performance.
- If the AND conditions are grouped, an index does not improve performance. For example:

  ```
  (dept = 'D101' AND hire_date) > {01/30/89}) OR
  exempt = 1
  ```

Improving Join Performance

When joining database tables, index tables can greatly improve performance. Unless the proper indexes are available, queries that use joins can take a long time.

Assume you have the following Select statement:

```
SELECT * FROM dept, emp WHERE dept.dept_id = emp.dept
```

In this example, the DEPT and EMP database tables are being joined using the department ID field. When the driver executes a query that contains a join, it processes the tables from left to right and uses an index on the second table's join field (the DEPT field of the EMP table).

To improve join performance, you need an index on the join field of the second table in the From clause. If there is a third table in the From clause, the driver also uses an index on the field in the third table that joins it to any previous table. For example:

```
SELECT * FROM dept, emp, addr
WHERE dept.dept_id = emp.dept AND emp.loc = addr.loc
```

In this case, you should have an index on the EMP.DEPT field and the ADDR.LOC field.

C ODBC API and Scalar Functions

This appendix lists the ODBC API functions that the DataDirect ODBC drivers support and the scalar functions, which you use in SQL statements.

API Functions

All database drivers are ODBC Level 1–compliant—they support all ODBC Core and Level 1 functions. They also support a limited set of Level 2 functions and a set of Level 3 functions. The drivers support the functions listed in Table C-1 and Table C-2. Any additions to these supported functions or differences in the support of specific functions are listed in the "ODBC Conformance Level" section in the individual driver chapters.

Table C-1. Supported 1.x and 2.x ODBC API Functions

Core Functions	Level 1 Functions
SQLAllocConnect	SQLColumns
SQLAllocEnv	SQLDriverConnect
SQLAllocStmt	SQLGetConnectOption
SQLBindCol	SQLGetData
SQLBindParameter	SQLGetFunctions
SQLCancel	SQLGetInfo
SQLColAttributes	SQLGetStmtOption
SQLConnect	SQLGetTypeInfo
SQLDescribeCol	SQLParamData
SQLDisconnect	SQLPutData
SQLDrivers	SQLSetConnectOption
SQLError	SQLSetStmtOption
SQLExecDirect	SQLSpecialColumns
SQLExecute	SQLStatistics
SQLFetch	SQLTables
SQLFreeConnect	**Level 2 Functions**
SQLFreeEnv	SQLBrowseConnect (all drivers except PROGRESS)
SQLFreeStmt	
SQLGetCursorName	SQLDataSources
SQLNumResultCols	SQLExtendedFetch (forward scrolling only)
SQLPrepare	SQLMoreResults
SQLRowCount	SQLNativeSql
SQLSetCursorName	SQLNumParams
SQLTransact	SQLParamOptions
	SQLSetScrollOptions

Table C-2. Supported 3.x ODBC API Functions

SQLAllocHandle	SQLGetData
SQLBindCol	SQLGetDescField
SQLBindParameter	SQLGetDescRec
SQLBrowseConnect (except for PROGRESS)	SQLGetDiagField
SQLBulkOperations	SQLGetDiagRec
SQLCancel	SQLGetEnvAttr
SQLCloseCursor	SQLGetFunctions
SQLColAttribute	SQLGetInfo
SQLColumns	SQLGetStmtAttr
SQLConnect	SQLGetTypeInfo
SQLCopyDesc	SQLMoreResults
SQLDataSources	SQLNativeSql
SQLDescribeCol	SQLNumParens
SQLDisconnect	SQLNumResultCols
SQLDriverConnect	SQLParamData
SQLDrivers	SQLPrepare
SQLEndTran	SQLPutData
SQLError	SQLRowCount
SQLExecDirect	SQLSetConnectAttr
SQLExecute	SQLSetCursorName
SQLExtendedFetch	SQLSetDescField
SQLFetch	SQLSetDescRec
SQLFetchScroll (forward scrolling only)	SQLSetEnvAttr
SQLFreeHandle	SQLSetStmtAttr
SQLFreeStmt	SQLSpecialColumns
SQLGetConnectAttr	SQLStatistics
SQLGetCursorName	SQLTables
	SQLTransact

Scalar Functions

The following tables list the scalar functions that ODBC supports; your database system may not support all of these functions. See the documentation for your database system to find out which functions are supported.

You can use these functions in SQL statements using the following syntax:

```
{fn scalar-function}
```

where *scalar-function* is one of the functions listed in the following tables. For example:

```
SELECT {fn UCASE(NAME)} FROM EMP
```

String Functions

Table C-3 lists the string functions that ODBC supports.

The string functions listed can take the following arguments:

- *string_exp* can be the name of a column, a string literal, or the result of another scalar function, where the underlying data type is SQL_CHAR, SQL_VARCHAR, or SQL_LONGVARCHAR.
- *start*, *length*, and *count* can be the result of another scalar function or a literal numeric value, where the underlying data type is SQL_TINYINT, SQL_SMALLINT, or SQL_INTEGER.

The string functions are one-based; that is, the first character in the string is character 1.

Character string literals must be surrounded in single quotation marks.

Table C-3. Scalar String Functions

Function	Returns
ASCII(*string_exp*)	ASCII code value of the leftmost character of *string_exp* as an integer.
BIT_LENGTH(*string_exp*) *[ODBC 3.0 only]*	The length in bits of the string expression.
CHAR(*code*)	The character with the ASCII code value specified by *code*. *code* should be between 0 and 255; otherwise, the return value is data-source dependent.
CHAR_LENGTH(*string_exp*) *[ODBC 3.0 only]*	The length in characters of the string expression, if the string expression is of a character data type; otherwise, the length in bytes of the string expression (the smallest integer not less than the number of bits divided by 8). (This function is the same as the CHARACTER_LENGTH function.)
CHARACTER_ LENGTH(string_exp) *[ODBC 3.0 only]*	The length in characters of the string expression, if the string expression is of a character data type; otherwise, the length in bytes of the string expression (the smallest integer not less than the number of bits divided by 8). (This function is the same as the CHAR_LENGTH function.)
CONCAT(*string_exp1*, *string_exp2*)	The string resulting from concatenating *string_exp2* and *string_exp1*. The string is system dependent.
DIFFERENCE(*string_exp1*, *string_exp2*)	An integer value that indicates the difference between the values returned by the SOUNDEX function for *string_exp1* and *string_exp2*.
INSERT(*string_exp1*, *start*, *length*, *string_exp2*)	A string where *length* characters have been deleted from *string_exp1* beginning at *start* and where *string_exp2* has been inserted into *string_exp*, beginning at *start*.
LCASE(*string_exp*)	Uppercase characters in *string_exp* converted to lowercase.
LEFT(*string_exp*,*count*)	The *count* of characters of *string_exp*.
LENGTH(*string_exp*)	The number of characters in *string_exp*, excluding trailing blanks and the string termination character.

***Table C-3. Scalar String Functions** (cont.)*

Function	Returns
LOCATE(*string_exp1*, *string_exp2*[,*start*])	The starting position of the first occurrence of *string_exp1* within *string_exp2*. If *start* is not specified the search begins with the first character position in *string_exp2*. If *start* is specified, the search begins with the character position indicated by the value of *start*. The first character position in *string_exp2* is indicated by the value 1. If *string_exp1* is not found, 0 is returned.
LTRIM(*string_exp*)	The characters of *string_exp*, with leading blanks removed.
OCTET_LENGTH(*string_exp*) *[ODBC 3.0 only]*	The length in bytes of the string expression. The result is the smallest integer not less than the number of bits divided by 8.
POSITION(*character_exp* IN *character_exp*) *[ODBC 3.0 only]*	The position of the first character expression in the second character expression. The result is an exact numeric with an implementation-defined precision and a scale of 0.
REPEAT(*string_exp*, *count*)	A string composed of *string_exp* repeated *count* times.
REPLACE(*string_exp1*, *string_exp2*, *string_exp3*)	Replaces all occurrences of *string_exp2* in *string_exp1* with *string_exp3.*
RIGHT(*string_exp*, *count*)	The rightmost *count* of characters in *string_exp*.
RTRIM(*string_exp*)	The characters of *string_exp* with trailing blanks removed.
SOUNDEX(*string_exp*)	A data-source-dependent string representing the sound of the words in *string_exp*.
SPACE(*count*)	A string consisting of *count* spaces.
SUBSTRING(*string_exp*, *start*, *length*)	A string derived from *string_exp* beginning at the character position *start* for *length* characters.
UCASE(*string_exp*)	Lowercase characters in *string_exp* converted to uppercase.

Numeric Functions

Table C-4 lists the numeric functions that ODBC supports.

The numeric functions listed can take the following arguments:

- *numeric_exp* can be a column name, a numeric literal, or the result of another scalar function, where the underlying data type is SQL_NUMERIC, SQL_DECIMAL, SQL_TINYINT, SQL_SMALLINT, SQL_INTEGER, SQL_BIGINT, SQL_FLOAT, SQL_REAL, or SQL_DOUBLE.
- *float_exp* can be a column name, a numeric literal, or the result of another scalar function, where the underlying data type is SQL_FLOAT.
- *integer_exp* can be a column name, a numeric literal, or the result of another scalar function, where the underlying data type is SQL_TINYINT, SQL_SMALLINT, SQL_INTEGER, or SQL_BIGINT.

Table C-4. Scalar Numeric Functions

Function	Returns
ABS(*numeric_exp*)	Absolute value of *numeric_exp.*
ACOS(*float_exp*)	Arccosine of *float_exp* as an angle in radians.
ASIN(*float_exp*)	Arcsine of *float_exp* as an angle in radians.
ATAN(*float_exp*)	Arctangent of *float_exp* as an angle in radians.
ATAN2(*float_exp1*, *float_exp*2)	Arctangent of the x and y coordinates, specified by *float_exp1* and *float_exp2* as an angle in radians.
CEILING(*numeric_exp*)	Smallest integer greater than or equal to *numeric_exp.*
COS(*float_exp*)	Cosine of *float_exp* as an angle in radians.
COT(*float_exp*)	Cotangent of *float_exp* as an angle in radians.
DEGREES(*numeric_exp*)	Number if degrees converted from *numeric_exp* radians.
EXP(*float_exp*)	Exponential value of *float_exp.*

Table C-4. Scalar Numeric Functions (cont.)

Function	Returns
FLOOR(*numeric_exp*)	Largest integer less than or equal to *numeric_exp*.
LOG(*float_exp*)	Natural log of *float_exp.*
LOG10(*float_exp*)	Base 10 log of *float_exp.*
MOD(*integer_exp1*, *integer_exp2*)	Remainder of *integer_exp1* divided by *integer_exp2*.
PI()	Constant value of pi as a floating-point number.
POWER(*numeric_exp*, *integer_exp*)	Value of *numeric_exp* to the power of *integer_exp*.
RADIANS(*numeric_exp*)	Number of radians converted from *numeric_exp* degrees.
RAND([*integer_exp*])	Random floating-point value using *integer_exp* as the optional seed value.
ROUND(*numeric_exp*, *integer_exp*)	*numeric_exp* rounded to *integer_exp* places right of the decimal (left of the decimal if *integer_exp* is negative).
SIGN(*numeric_exp*)	Indicator of the sign of *numeric_exp*. If *numeric_exp* < 0, -1 is returned. If *numeric_exp* = 0, 0 is returned. If *numeric_exp* > 0, 1 is returned.
SIN(*float_exp*)	Sine of *float_exp*, where *float_exp* is an angle in radians.
SQRT(*float_exp*)	Square root of *float_exp*.
TAN(*float_exp*)	Tangent of *float_exp*, where *float_exp* is an angle in radians.
TRUNCATE(*numeric_exp*, *integer_exp*)	*numeric_exp* truncated to *integer_exp* places right of the decimal. (If *integer_exp* is negative, truncation is to the left of the decimal.)

Date and Time Functions

Table C-5 lists the date and time functions that ODBC supports.

The date and time functions listed can take the following arguments:

- *date_exp* can be a column name, a date or timestamp literal, or the result of another scalar function, where the underlying data type can be represented as SQL_CHAR, SQL_VARCHAR, SQL_DATE, or SQL_TIMESTAMP.
- *time_exp* can be a column name, a timestamp or timestamp literal, or the result of another scalar function, where the underlying data type can be represented as SQL_CHAR, SQL_VARCHAR, SQL_TIME, or SQL_TIMESTAMP.
- *timestamp_exp* can be a column name; a time, date, or timestamp literal; or the result of another scalar function, where the underlying data type can be represented as SQL_CHAR, SQL_VARCHAR, SQL_TIME, SQL_DATE, or SQL_TIMESTAMP.

Table C-5. Scalar Time and Date Functions

Function	Returns
CURRENT_DATE() *[ODBC 3.0 only]*	Current date.
CURRENT_TIME[(*time-precision*)] *[ODBC 3.0 only]*	Current local time. The *time-precision* argument determines the seconds precision of the returned value.
CURRENT_TIMESTAMP[(*timestamp-precision*)] *[ODBC 3.0 only]*	Current local date and local time as a timestamp value. The *timestamp-precision* argument determines the seconds precision of the returned timestamp.
CURDATE()	Current date as a date value.
CURTIME()	Current local time as a time value.

Table C-5. Scalar Time and Date Functions *(cont.)*

Function	Returns
DAYNAME(*date_exp*)	Character string containing a data-source-specific name of the day for the day portion of *date_exp*.
DAYOFMONTH(*date_exp*)	Day of the month in *date_exp* as an integer value (1–31).
DAYOFWEEK(*date_exp*)	Day of the week in *date_exp* as an integer value (1–7).
DAYOFYEAR(*date_exp*)	Day of the year in *date_exp* as an integer value (1–366).
HOUR(*time_exp*)	Hour in *time_exp* as an integer value (0–23).
MINUTE(*time_exp*)	Minute in *time_exp* as an integer value (0–59).
MONTH(*date_exp*)	Month in *date_exp* as an integer value (1–12).
MONTHNAME(*date_exp*)	Character string containing the data source-specific name of the month.
NOW()	Current date and time as a timestamp value.
QUARTER(*date_exp*)	Quarter in *date_exp* as an integer value (1–4).
SECOND(*time_exp*)	Second in *date_exp* as an integer value (0–59).
TIMESTAMPADD(*interval*, *integer_exp*, *time_exp*)	Timestamp calculated by adding *integer_exp* intervals of type interval to *time_exp*. *interval* can be SQL_TSI_FRAC_SECOND SQL_TSI_SECOND SQL_TSI_MINUTE SQL_TSI_HOUR SQL_TSI_DAY SQL_TSI_WEEK SQL_TSI_MONTH SQL_TSI_QUARTER SQL_TSI_YEAR Fractional seconds are expressed in billionths of a second.

Table C-5. Scalar Time and Date Functions (cont.)

Function	Returns
TIMESTAMPDIFF(*interval*, *time_exp1*, *time_exp2*)	Integer number of intervals of type *interval* by which *time_exp2* is greater than *time_exp1*. *interval* has the same values as TIMESTAMPADD. Fractional seconds are expressed in billionths of a second.
WEEK(*date_exp*)	Week of the year in *date_exp* as an integer value (1–53).
YEAR(*date_exp*)	Year in *date_exp*. The range is data-source dependent.

System Functions

Table C-6 lists the system functions that ODBC supports.

Table C-6. Scalar System Functions

Function	Returns
DATABASE()	Name of the database, corresponding to the connection handle (*hdbc*).
IFNULL(*exp*,*value*)	*value*, if *exp* is null.
USER()	Authorization name of the user.

D Locking and Isolation Levels

This appendix discusses locking and isolation levels and how their settings can affect the data you retrieve. Different database systems support different locking and isolation levels. See the section "Isolation and Lock Levels Supported" in the appropriate driver chapter.

Locking

Locking is a database operation that restricts a user from accessing a table or record. Locking is used in situations where more than one user might try to use the same table or record at the same time. By locking the table or record, the system ensures that only one user at a time can affect the data.

Locking is critical in multiuser databases, where different users can try to access or modify the same records concurrently. Although such concurrent database activity is desirable, it can create problems. Without locking, for example, if two users try to modify the same record at the same time, they might encounter problems ranging from retrieving bad data to deleting data that the other user needs. If, however, the first user to access a record can lock that record to temporarily prevent other users from modifying it, such problems can be avoided. Locking provides a way to manage concurrent database access while minimizing the various problems it can cause.

Isolation Levels

An isolation level represents a particular locking strategy employed in the database system to improve data consistency. The higher the isolation level, the more complex the locking strategy behind it. The isolation level provided by the database determines whether a transaction will encounter the following behaviors in data consistency:

Dirty reads	User 1 modifies a row. User 2 reads the same row before User 1 commits. User 1 performs a rollback. User 2 has read a row that has never really existed in the database. User 2 may base decisions on false data.
Non-repeatable reads	User 1 reads a row but does not commit. User 2 modifies or deletes the same row and then commits. User 1 rereads the row and finds it has changed (or has been deleted).
Phantom reads	User 1 uses a search condition to read a set of rows but does not commit. User 2 inserts one or more rows that satisfy this search condition, then commits. User 1 rereads the rows using the search condition and discovers rows that were not present before.

Isolation levels represent the database system's ability to prevent these behaviors. The American National Standards Institute (ANSI) defines four isolation levels:

- Read uncommitted (0)
- Read committed (1)
- Repeatable read (2)
- Serializable (3)

In ascending order (0–3), these isolation levels provide an increasing amount of data consistency to the transaction. At the lowest level, all three behaviors can occur. At the highest level, none can occur. The success of each level in preventing these behaviors is due to the locking strategies that they employ, which are as follows:

Read uncommitted (0)	Locks are obtained on modifications to the database and held until end of transaction (EOT). Reading from the database does not involve any locking.
Read committed (1)	Locks are acquired for reading and modifying the database. Locks are released after reading but locks on modified objects are held until EOT.
Repeatable read (2)	Locks are obtained for reading and modifying the database. Locks on all modified objects are held until EOT. Locks obtained for reading data are held until EOT. Locks on non-modified access structures (such as indexes and hashing structures) are released after reading.
Serializable (3)	All data read or modified is locked until EOT. All access structures that are modified are locked until EOT. Access structures used by the query are locked until EOT.

Table D-1 shows what data consistency behaviors can occur at each isolation level.

Table D-1. Isolation Levels and Data Consistency

Level	Dirty Read	Nonrepeatable Read	Phantom Read
0, Read uncommitted	Yes	Yes	Yes
1, Read committed	No	Yes	Yes
2, Repeatable read	No	No	Yes
3, Serializable	No	No	No

Although higher isolation levels provide better data consistency, this consistency can be costly in terms of the concurrency provided to individual users. Concurrency is the ability of multiple users to access and modify data simultaneously. As isolation levels increase, so does the chance that the locking strategy used will create problems in concurrency.

Put another way: The higher the isolation level, the more locking involved, and the more time users may spend waiting for data to be freed by another user. Because of this inverse relationship between isolation levels and concurrency, you must consider how people use the database before choosing an isolation level. You must weigh the trade-offs between data consistency and concurrency, and decide which is more important.

Locking Modes and Levels

Different database systems employ various locking modes, but they have two basic ones in common: shared and exclusive. Shared locks can be held on a single object by multiple users. If one user has a shared lock on a record, then a second user can also get a shared lock on that same record; however, the second user cannot get an exclusive lock on that record. Exclusive locks are exclusive to the user that obtains them. If one user has an exclusive lock on a record, then a second user cannot get either type of lock on the same record.

Performance and concurrency can also be affected by the locking level used in the database system. The locking level determines the size of an object that is locked in a database. For example, many database systems let you lock an entire table, as well as individual records. An intermediate level of locking, page-level locking, is also common. A page contains one or more records and is typically the amount of data read from the disk in a single disk access. The major disadvantage of page-level locking is that if one user locks a record, a second user may not be able to lock other records because they are stored on the same page as the locked record.

E Performance Design of ODBC Applications

This appendix provides information about performance issues and guidelines for developing performance-optimized, ODBC applications for ODBC/OLE DB Adapter and ODBC drivers.

Optimizing Performance

Developing performance-oriented ODBC applications is not easy. Microsoft's *ODBC Programmer's Reference* does not provide information about system performance. In addition, ODBC drivers and the ODBC driver manager do not return warnings when applications run inefficiently.

The following sections contain guidelines compiled by examining the ODBC implementations of numerous shipping ODBC applications.

Table E-1 summarizes some common ODBC system performance problems and possible solutions:.

Table E-1. Common ODBC System Performance Problems and Solutions

Problem	Solution
Network communication is slow	Reduce network traffic
The process of evaluating complex SQL queries on the database server is slow and might reduce concurrency	Simplify queries

Table E-1. Common ODBC System Performance Problems and Solutions (cont.)

Problem	Solution
Excessive calls from the application to the driver decreases performance	Optimize application-to-driver interaction
Disk input/output is slow	Limit disk input/output

The guidelines are divided into five sections: "Catalog Functions," "Retrieving Data," "ODBC Function Selection," "Design Options," and "Updating Data."

Catalog Functions

The following ODBC functions are defined to be catalog functions:

- SQLColumns
- SQLColumnPrivileges
- SQLForeignKeys
- SQLGetTypeInfo
- SQLProcedures
- SQLProcedureColumns
- SQLSpecialColumns
- SQLStatistics
- SQLTables

While some drivers implement SQLGetTypeInfo as hard-coded information, many drivers must query the server to obtain accurate information about which types are supported (for example, to find dynamic types such as user defined types, and so on). Therefore, SQLGetTypeInfo is included in this list of potentially expensive ODBC functions.

Catalog Functions Are Relatively Slow

Catalog functions are relatively slow compared to other ODBC functions. Applications should cache information returned from catalog functions so that multiple executions are not needed.

While almost no ODBC application can be written without catalog functions, their use should be minimized. To return all result column information *mandated* by the ODBC specification, a driver may have to perform multiple queries, joins, subqueries, and/or unions in order to return the necessary result set for a single call to a catalog function. These particular elements of the SQL language are performance expenses. Frequent use of catalog functions in an application will likely result in poor performance.

Applications should cache information from catalog functions. For example, call SQLGetTypeInfo once in the application and cache away the elements of the result set that your application depends on. It is unlikely that any application uses all elements of the result set generated by a catalog function, so the cache of information should not be difficult to maintain.

Passing Null Arguments

Passing null arguments to catalog functions results in generating time consuming queries. In addition, network traffic potentially increases due to unwanted result set information. Always supply as many non-null arguments to catalog functions as possible.

Because catalog functions are slow, applications should invoke them as efficiently as possible. Many applications pass the fewest non-null arguments necessary for the function to return success.

For example, consider a call to SQLTables where the application requests information about table "Customers." Often, this call is coded in a manner similar to the following example:

```
rc = SQLTables (NULL, NULL, NULL, NULL, "Customers", SQL_NTS,
    NULL);
```

A driver could turn this SQLTables call into SQL similar to:

```
SELECT ...  FROM SysTables WHERE TableName = ’Customers’ UNION ALL
SELECT ... FROM SysViews WHERE ViewName = ’Customers’ UNION ALL
SELECT ... FROM SysSynonyms WHERE SynName = ’Customers’
ORDER BY ...
```

Sometimes, little information is known about the object for which you are requesting information. Any information that the application can send the driver when calling catalog functions can result in improved performance and reliability.

Using the previous example, suppose three "Customers" tables were returned in the result set:

- The first table was owned by the user
- The second table was owned by the sales department
- The third table was a view created by management

It might not be obvious to the user which table to choose. If the application had specified the OwnerName argument for the SQLTables call, only one table would be returned and performance would increase. This is because less network traffic was required to return only one result row and unwanted rows were filtered by the database.

In addition, if the TableType argument can be supplied, then the SQL sent to the server can be optimized from a three query union to a single, Select statement as shown:

```
SELECT ... FROM SysTables WHERE TableName = 'Customers' and
   Owner = 'Beth'
```

SQLColumns

Avoid using SQLColumns to determine characteristics about a table. Instead, use a dummy query with SQLDescribeCol.

Consider an application that allows the user to choose the columns that will be selected. Should the application use SQLColumns to return information about the columns to the user or instead prepare a dummy query and call SQLDescribeCol?

Case 1: SQLColumns Method

```
rc = SQLColumns (... "UnknownTable" ...);
// This call to SQLColumns will generate a query to the system
// catalogs... possibly a join which must be prepared,
// executed, and produce a result set
rc = SQLBindCol (...);
rc = SQLExtendedFetch (...);
// user must retrieve N rows from the server
// N = # result columns of UnknownTable
// result column information has now been obtained
```

Case 2: SQLDescribeCol Method

```
// prepare dummy query
rc = SQLPrepare (... "SELECT * from UnknownTable
   WHERE 1 = 0" ...);
// query is never executed on the server - only prepared
rc = SQLNumResultCols (...);
for (irow = 1; irow <= NumColumns; irow++) {
   rc = SQLDescribeCol (...)
   // + optional calls to SQLColAttributes
   }
// result column information has now been obtained
// Note we also know the column ordering within the table!
// This information cannot be
// assumed from the SQLColumns example.
```

In both cases a query is sent to the server, but in Case 1 the query must be evaluated and form a result set that must be sent to the client. Clearly, Case 2 is the better performing model.

To somewhat complicate this discussion, let us consider a DBMS server that does not natively support preparing a SQL statement. The performance of Case 1 does not change but Case 2 increases minutely because the dummy query must be evaluated instead of only prepared. Because the Where clause of the query always evaluates to FALSE, the query generates no result rows and should execute without accessing table data. For even this type of driver, method 2 out performs method 1.

Retrieving Data

This section provides information about retrieving data with ODBC applications.

Retrieving Long Data

Retrieving long data (SQL_LONGVARCHAR and SQL_LONGVARBINARY data) across the network is very resource intensive and thus slow. Applications should avoid requesting long data unless it is absolutely necessary.

How often do users want to *see* long data? Most users don't want to see such information. If the user does wish to see these result items, then the application can requery the database specifying only the long columns in the select list. This method allows the average user to retrieve the result set without having to pay a high performance penalty for network traffic.

Although the best method is to exclude long data from the select list, some applications do not formulate the select list before sending the query to the ODBC driver (that is, some applications simply `select * from <table name> ...`). If the select list contains long data then some drivers *must* retrieve that data at fetch time even if the application does not bind the long data in the result set. If possible, the designer should attempt to implement a method that does not retrieve all columns of the table.

Reducing the Size of Data Retrieved

Reduce the size of any data being retrieved to some manageable limit by calling SQLSetStmtOption with the SQL_MAX_LENGTH option. This reduces network traffic and improves performance.

While eliminating SQL_LONGVARCHAR and SQL_LONGVARBINARY data from the result set is ideal for performance optimization, sometimes, long data must be retrieved. When this is the case, remember that most users do not want to see 100 KB, or more, of text on the screen. What techniques, if any, are available to limit the amount of data retrieved?

Many application developers mistakenly assume that if they call SQLGetData with a container of size *x* that the ODBC driver only retrieves *x* bytes of information from the server. Because SQLGetData can be called multiple times for any one column, most drivers optimize their network use by retrieving long data in large chunks and then returning it to the user when requested. For example:

```
char CaseContainer[1000];
...
rc = SQLExecDirect (hstmt, "SELECT CaseHistory
FROM Cases WHERE
   CaseNo = 71164", SQL_NTS);
...
rc = SQLFetch (hstmt);
rc = SQLGetData (hstmt, 1, CaseContainer,(SWORD)
sizeof(CaseContainer), ...);
```

At this point, it is more likely that an ODBC driver retrieves 64 KB of information from the server instead of 1000 bytes. One 64 KB retrieval is less expensive than sixty-four, 1000-byte retrievals in terms of network access. Unfortunately, the application may not call SQLGetData again; thus, the first and only retrieval of CaseHistory would be slowed by the fact that 64 KB of data had to be sent across the network.

Many ODBC drivers allow limiting the amount of data retrieved across the network by supporting the statement option SQL_MAX_LENGTH. This attribute allows the driver to communicate to the database server that only Z bytes of data are pertinent to the client. The server responds by sending only the first Z bytes of data for *all* result columns. This optimization greatly reduces network traffic and thus improves performance of the client. Our example returned just one row, but consider the case where 100 rows are returned in the result set. The performance improvement is substantial.

Using Bound Columns

Retrieving data through bound columns (SQLBindCol) instead of using SQLGetData reduces the ODBC call load and thus improves performance.

Consider the following pseudo-code fragment:

```
rc = SQLExecDirect (hstmt, "SELECT <20 columns>
FROM Employees
   WHERE HireDate >= ?", SQL_NTS);
do {
rc  = SQLFetch (hstmt);
// call SQLGetData 20 times
} while ((rc == SQL_SUCCESS) || (rc ==
SQL_SUCCESS_WITH_INFO));
```

Suppose the query returns 90 result rows. More than 1890 ODBC calls are made (20 calls to SQLGetData x 90 result rows + 91 calls to SQLFetch).

Consider the same scenario that uses SQLBindCol instead of SQLGetData:

```
rc = SQLExecDirect (hstmt, "SELECT <20 columns>
FROM Employees
   WHERE HireDate >= ?", SQL_NTS);
// call SQLBindCol 20 times
do {
rc  = SQLFetch (hstmt);
} while ((rc == SQL_SUCCESS) || (rc ==
SQL_SUCCESS_WITH_INFO));
```

The number of ODBC calls made is reduced from more than 1890 to about 110 (20 calls to SQLBindCol + 91 calls to SQLFetch). In addition to reducing the call load many drivers optimize use of SQLBindCol by binding result information directly from the database server into the user's buffer. That is, instead of the driver retrieving information into a container then copying that information to the user's buffer, the driver simply requests the information from the server be placed directly into the user's buffer.

Using SQLExtendedFetch Instead of SQLFetch

Use SQLExtendedFetch to retrieve data instead of SQLFetch. The ODBC call load decreases (resulting in better performance,) and the code is less complex (resulting in more maintainable code).

Most ODBC drivers now support SQLExtendedFetch for forward only cursors; yet, most ODBC applications use SQLFetch to retrieve data. Again consider the example above using SQLExtendedFetch instead of SQLFetch:

```
rc = SQLSetStmtOption (hstmt, SQL_ROWSET_SIZE, 100);
// use arrays of 100 elements
rc = SQLExecDirect (hstmt, "SELECT <20 columns> FROM
   Employees WHERE HireDate >= ?", SQL_NTS);
// call SQLBindCol 1 time specifying row-wise binding
do {
rc = SQLExtendedFetch (hstmt, SQL_FETCH_NEXT, 0, &RowsFetched,
   RowStatus);
} while ((rc == SQL_SUCCESS) || (rc == SQL_SUCCESS_WITH_INFO));
```

The number of ODBC calls made by the application is reduced from 110 in the last example to four (1 SQLSetStmtOption + 1 SQLExecDirect + 1 SQLBindCol + 1 SQLExtendedFetch). Note the total savings from an initial call load of more than 1890 ODBC calls in the first presentation of the example to four above. In addition to reducing the call load, many ODBC drivers retrieve data from the server in arrays that further improves the performance by reducing network traffic.

For ODBC drivers that do not support SQLExtendedFetch, the application can enable forward-only cursors using the ODBC cursor library (call SQLSetConnectOption using SQL_ODBC_CURSORS/ SQL_CUR_USE_IF_NEEDED). While using the cursor library does not improve performance, it should not be detrimental to application response time when using forward only cursors (no logging is required). Furthermore, using the cursor library when SQLExtendedFetch is not supported natively by the driver simplifies the code because the application can always depend on SQLExtendedFetch being available. The application need not code two algorithms (one using SQLExtendedFetch and one using SQLFetch).

ODBC Function Selection

This section provides guidelines for selecting functions for performance optimization.

Using SQLPrepare/SQLExecute and SQLExecDirect

Do not assume that SQLPrepare/SQLExecute is always as efficient as SQLExecDirect. Use SQLExecDirect for queries that will be executed once and SQLPrepare/SQLExecute for queries that will be executed more than once.

ODBC drivers are optimized based on the perceived use of the functions that are being executed. SQLPrepare/SQLExecute is optimized for multiple executions of a statement that most likely uses parameter markers. SQLExecDirect is optimized for a single execution of a SQL statement. Unfortunately, more than 75% of all ODBC applications use SQLPrepare/SQLExecute *exclusively*.

The pitfall of always coding SQLPrepare/SQLExecute can be understood better by considering an ODBC driver that implements SQLPrepare by creating a stored procedure on the server that contains the prepared statement. Creating a stored procedure has substantial overhead, but the ODBC driver is assuming is that the statement will be *executed* multiple times. While stored procedure creation is relatively expensive, execution is minimal because the query is parsed and optimization paths are stored at create procedure time. Using SQLPrepare/SQLExecute for a statement that will be executed only once with such an ODBC driver will result in unneeded overhead. Furthermore, applications that use SQLPrepare/SQLExecute for large single execution query batches will almost certainly exhibit poor performance when used with ODBC drivers as previously discussed.

Similar arguments can be used to show applications that always use SQLExecDirect cannot perform as well as those that logically use a combination of SQLPrepare/SQLExecute and SQLExecDirect sequences.

Using SQLPrepare and Multiple SQLExecute Calls

Applications that use SQLPrepare and multiple SQLExecute calls should use SQLParamOptions if available. Passing arrays of parameter values reduces the ODBC call load and greatly reduces network traffic.

Consider the following example designed to insert data:

```
rc = SQLPrepare (hstmt, "INSERT INTO DailyLedger
(...) VALUES
    (?,?,...)", SQL_NTS);
// bind parameters
...
do {
// read ledger values into bound parameter buffers
...
rc = SQLExecute (hstmt);      // insert row
} while ! (eof);
```

If there are 100 rows to insert then SQLExecute is called 100 times resulting in 100 network requests to the server. Consider, however, an algorithm that uses parameter arrays by calling SQLParamOptions:

```
rc = SQLPrepare (hstmt, "INSERT INTO DailyLedger
(...) VALUES
   (?,?,...)", SQL_NTS);
rc = SQLParamOptions (hstmt, (UDWORD) 50,
&CurrentRow);
// pass 50 parameters per execute
// bind parameters
...
do {
// read up to 50 ledger values into bound
parameter buffers
...
rc = SQLExecute (hstmt);      // insert row
```

The call load has been reduced from 100 to just 2 SQLExecute calls; furthermore, network traffic is reduced considerably. Some ODBC drivers do not support SQLParamOptions. To achieve high performance, applications should contain algorithms for using SQLParamOptions if the ODBC driver supports the function. SQLParamOptions is ideal for copying data into new tables or bulk loading tables.

Using the Cursor Library

Do not automatically use the cursor library if scrollable cursors are provided by the driver. The cursor library creates local temporary log files, which are expensive to generate and provide worse performance than using native scrollable cursors.

The cursor library adds support for static cursors, which simplifies the coding of applications that use scrollable cursors. However, the cursor library creates temporary log files on the user's local disk drive to accomplish the task. Disk I/O is typically one of the slowest operations on personal computers. While the benefits of the cursor library are great, applications should not automatically choose to use the cursor library if an ODBC driver supports scrollable cursors natively.

ODBC drivers that support scrollable cursors typically achieve high performance by requesting that the DBMS server produce a scrollable result set instead of emulating the capability by creating log files.

Many applications use

```
rc = SQLSetConnectOption (hdbc, SQL_ODBC_CURSORS,
   SQL_CUR_USE_ODBC);
```

but should use

```
rc = SQLSetConnectOption (hdbc, SQL_ODBC_CURSORS,
   SQL_CUR_USE_IF_NEEDED);
```

Design Options

This section provides guidelines for designing ODBC applications.

Managing Connections

Connection management is important to application performance. Designers should optimize applications by connecting once and using multiple statement handles instead of performing multiple connections. Most ODBC applications contain poorly designed elements for connection management. Connecting to a data source should be avoided after establishing an initial connection.

Some ODBC applications are designed to call informational gathering routines that have no record of already attached connection handles. For example, some applications establish a connection and then call a routine in a separate DLL or shared library that reattaches and gathers information about the driver.

Although gathering driver information at connect time is a good algorithm, it should not be minimized by connecting twice. At least one popular ODBC enabled application connects a second time to gather driver information but *never* disconnects the second connection. Applications that are designed as separate entities should pass the already connected HDBC pointer to the data collection routine instead of establishing a second connection.

Another poor practice is to connect and disconnect several times throughout your application to perform SQL statements. Connection handles can have multiple statement handles associated with them. Statement handles are defined to be memory storage for information about SQL statements. Why then do many applications allocate new connection handles to perform SQL statements? Applications should use *statement* handles to manage multiple SQL statements.

Connection and statement handling should not be delayed until implementation. Spending time and thoughtfully handling connection management improves application performance and maintainability.

Committing Data

Committing data is extremely disk I/O intensive and slow. Always turn autocommit off, if the driver can support transactions.

What is actually involved in a commit? The database server must flush back to disk every data page that contains updated or new data. Note that this is not a sequential write but a searched write to replace existing data in the table. By default, autocommit is on when connecting to a data source. Autocommit mode is typically detrimental to performance because of the extreme amount of disk i/o needed to commit *every* operation.

To further reduce performance some database servers do not provide an "autocommit mode." For this type of server, the ODBC driver must explicitly issue a COMMIT statement and perhaps a BEGIN TRANSACTION for *every* operation sent to the server. In addition to the large amount of disk I/O required to support autocommit mode, a performance penalty is paid for up to three network requests for every statement issued by an application.

Asynchronous Execution

Design your application to take advantage of data sources that support asynchronous execution. Asynchronous calls do not perform faster but well-designed applications *appear* to run more efficiently.

By default, an application makes calls to an ODBC driver that then executes statements against the DBMS server in a synchronous manner. In this mode of operation, the driver does not return control to the application until its own request to the server is complete. For statements which take more than a few seconds to complete execution, this can result in the perception of poor performance to the end user.

Some data sources support asynchronous execution. When in asynchronous mode, an application makes calls to an ODBC driver and control is returned almost immediately. In this mode the driver returns the status SQL_STILL_EXECUTING to the application and then sends the appropriate request to the database backend for execution. The application polls the driver at various intervals at which point the driver itself polls the server to see if the query has completed execution. If the query is still executing, the status SQL_STILL_EXECUTING is returned to the application. If it has completed, a status such as SQL_SUCCESS is returned and the application can then begin to fetch records.

Turning on asynchronous execution does not by itself improve performance. Well-designed applications, however, can take advantage of asynchronous query execution by allowing the end user to work on other things while the query is being evaluated on the server. Perhaps users will start one or more subsequent queries or choose to work in another application, all while the query is executing on the server. Designing for asynchronous execution makes your application *appear* to run faster by allowing the end user to work concurrently on multiple tasks.

Updating Data

This section provides guidelines fro updating data stored in databases with information supplied by the end user.

Using Positional Updates and Deletes

Use positioned updates and deletes or SQLSetPos to update data.

Designing an efficient method for updating data is difficult. While positioned updates do not apply to all types of applications, developers should attempt to use positioned updates and deletes. Positioned updates (either through "update where current of cursor" or through SQLSetPos) allow the developer to update data simply by positioning the database cursor to the appropriate row to be changed and signal the driver to "change the data here." The designer is not forced to build a complex SQL statement but is simply required to supply the data that is to be changed.

Besides making the application more easily maintainable, positioned updates typically result in improved performance. Because the database server is already positioned on the row (for the Select statement in process), performance-expensive operations to locate the row to be changed are not needed. If the row must be located, the server typically has an internal pointer to the row available (for example, ROWID).

Using SQLSpecialColumns

Use SQLSpecialColumns to determine the optimal set of columns to use in the Where clause for updating data. Many times pseudo-columns provide the fastest access to the data, and these columns can only be determined by using SQLSpecialColumns.

Some applications cannot be designed to take advantage of positional updates and deletes. These applications typically update data by forming a Where clause consisting of some subset of the column values returned in the result set. Some applications might formulate the Where clause by using all searchable result columns or by calling SQLStatistics to find columns that might be part of a unique index. These methods typically work, but might result in fairly complex queries.

Consider the following:

```
rc = SQLExecDirect (hstmt, "SELECT first_name,
last_name, ssn,
    address, city, state, zip FROM emp",
SQL_NTS);
// fetchdata
...
rc = SQLExecDirect (hstmt, "UPDATE EMP SET ADDRESS
= ?
    WHERE first_name = ? and last_name = ? and
ssn = ?
    and address = ? and city = ? and state = ?
and zip = ?",
    SQL_NTS);
// fairly complex query
```

Applications should call SQLSpecialColumns/SQL_BEST_ROWID to retrieve the most optimal set of columns (possibly a pseudo-column) that identifies any given record. Many databases support special columns that are not explicitly defined by the user in the table definition but are "hidden" columns of every table (for example, ROWID and TID). These pseudo-columns almost always provide the fastest access to the data because they typically are pointers to the exact location of the record. Because pseudo-columns are not part of the explicit table definition, they are not returned from SQLColumns. The only method of determining if pseudo-columns exist is to call SQLSpecialColumns.

Consider the previous example again:

```
...
rc = SQLSpecialColumns (hstmt, ..... 'emp', ...);
...
rc = SQLExecDirect (hstmt, "SELECT first_name,
last_name, ssn,
    address, city, state, zip, ROWID FROM emp",
SQL_NTS);
// fetch data and probably "hide" ROWID from the
user
...
rc = SQLExecDirect (hstmt, "UPDATE emp SET address
= ? WHERE
    ROWID = ?", SQL_NTS);
// fastest access to the data!
```

If your data source does not contain special pseudo-columns, then the result set of SQLSpecialColumns consists of the columns of the most optimal unique index on the specified table (if a unique index exists); therefore, your application need not additionally call SQLStatistics to find the smallest unique index.

F Threading

The ODBC specification mandates that all drivers must be thread-safe; that is, drivers must not fail when database requests are made on separate threads. It is a common misperception that issuing requests on separate threads will always result in improved throughput. Because of network transport and database server limitations, some drivers may serialize threaded requests to the server to ensure thread safety.

The ODBC 3.0 specification does not provide a method to find out how a driver will service threaded requests although this information is quite useful to an application. All DataDirect drivers provide this information to the user via the SQLGetInfo information type 1028.

The result of calling SQLGetInfo with 1028 is a SQL_USMALLINT flag which denotes the session's thread model. A return value of 0 denotes that the session is fully thread enabled and that all requests will fully utilize the threaded model. A return value of 1 denotes that the session is restricted at the connection level. Sessions of this type are fully thread enabled when simultaneous threaded requests are made with statement handles that do not share the same connection handle. In this model, if multiple requests are made from the same connection, then the first request received by the driver is processed immediately and all subsequent requests are serialized. A return value of 2 denotes that the session is thread impaired and all requests are serialized by the driver.

Consider the following code fragment:

```
rc = SQLGetInfo (hdbc, 1028, &ThreadModel, NULL, NULL);

If (rc == SQL_SUCCESS) {
   // driver is a MERANT driver which can report
   // threading information

  if (ThreadModel == 0)
  // driver is unconditionally thread enabled
  // application can take advantage of threading

  else if (ThreadModel == 1)
  // driver is thread enabled when thread requests are
  // from different connections
  // some applications can take advantage of threading

  else if (ThreadModel == 2)
  // driver is thread impaired
  // application should only use threads if it reduces
  // program complexity

}
else
  // driver is only guaranteed to be thread-safe
  // use threading at your own risk
```

Table F-1 summarizes the threading information available at this time for DataDirect drivers. Always consult the README file for the most up-to-date information as the threading information is subject to change with new database transport and server revisions.

Table F-1. Threading Information

Driver	Fully Threaded	Thread Per Connect	Thread Impaired
Btrieve	✓		
dBASE	✓		
DB2		✓	
Excel Workbook	✓		
Informix		✓	
Open INGRES			✓
Oracle		✓	
Paradox	✓		
PROGRESS			✓
SQLBase		✓	
SQL Server		✓	
Sybase (Open Client 10.x)			✓
Sybase (Open Client 11.x)		✓	
Sybase ASE		✓	
Text	✓		
XML			✓

G Microsoft Query ’97

This Appendix applies only to Windows platforms.

Creating a Flat-File Data Source for Use with Microsoft Query ’97

To use a flat-file database driver with Microsoft Query ’97, you must alter the data source alias outside of Microsoft Query ’97. The data source alias created within Microsoft Query sets a default database, which is the Microsoft Query ’97 working directory. Most likely, the Microsoft Query ’97 working directory does not contain your data files.

The following steps describe how to update a flat-file data source. In this example, a dBASE data file is used:

1 Open WordPad or another text editor and edit the data source file that was created in Microsoft Query ’97. The file will have a .dsn extension and will be located in the Microsoft Query ’97 working directory.

   The information will look similar to the section below:

```
[ODBC]
DRIVER={MERANT 3.xx 32-BIT dBASEFile (*.dbf)}
DB=d:\msoffice\query97
```

2 Edit the DB entry to specify the directory that contains your data files. For example, the modified file may look similar to:

```
[ODBC]
DRIVER={MERANT 3.xx 32-BIT dBASEFile (*.dbf)}
DB=c:\data\sales
```

3 Save the file and exit the editor.

Using Microsoft Query '97 with Single-Connect Data Sources

To use data source that are limited to a single connection per session (Btrieve and DB2 data sources), you must create the data source as a FileDSN through the ODBC Administrator.

Follow these steps to create a Btrieve DB2 data source. A DB2 data source is used in this example:

1 Start the ODBC Administrator.

2 Click the **File DSN** tab.

3 Click **Add**.

4 Select the MERANT 3.xx 32-BIT DB2 data source. Click **Next.**

   You are prompted for the path name of the new file data source name.

5 Type the Microsoft Query '97 directory followed by your new data source name. For example:

```
d:\msoffice\msquery\DB2Test.dsn
```

   Click **Next.**

6 Click **Finish** to validate the new File DSN entry.

The driver's logon box is displayed. Specify the logon options as you normally would for the DB2 database. Click **OK.**

7 Exit the ODBC Administrator.

8 Open WordPad or another text editor and edit the data source file you created in the ODBC Administrator. The file has a .dsn extension and will be located in the Microsoft Query '97 working directory. In our example, the file name is DB2Test.dsn.

The information will look similar to the following:

```
[ODBC]
DRIVER={MERANT 3.xx 32-BIT DB2}
DB=test
UID=TEST1
```

9 Add the following entry to specify the applicable driver option:

```
WA=4
```

The modified file will look similar to the following:

```
[ODBC]
DRIVER={MERANT 3.xx 32-BIT DB2}
WA=4
DB=test
UID=TEST1
```

10 Exit the editor.

H The UNIX Environment

UNIX

This appendix contains specific information about using Connect ODBC in the UNIX environment.

The System Information File (.odbc.ini)

In the UNIX environment, there is no ODBC Administrator. To configure a data source, you must edit the system information file, a plain text file that is normally located in the user's $HOME directory and is usually called *.odbc.ini*. This file is maintained using any text editor to define data source entries as described in the "Connecting to a Data Source Using a Connection String" section of each driver's chapter. You must use the long name of connection string attributes when defining data source entries. A sample file (odbc.ini) is located in the driver installation directory.

UNIX support of the database drivers also permits the use of a centralized system information file that a system administrator can control. This is accomplished by setting the environment variable ODBCINI to point to the fully qualified pathname of the centralized file. For example, in the C shell you could set this variable as follows:

```
setenv ODBCINI /opt/odbc/system_odbc.ini
```

In the Bourne or Korn shell, you would set it as:

```
ODBCINI=/opt/odbc/system_odbc.ini;export ODBCINI
```

The search order for the location of the system information file file is as follows:

1 Check ODBCINI

2 Check $HOME for .odbc.ini

There must be an [ODBC] section in the system information file that includes the InstallDir keyword. The value of this keyword must be the path to the directory under which the /lib and /messages directories are contained. For example, if you choose the default install directory, then the following line must be in the [ODBC] section:

```
InstallDir=/opt/odbc
```

Sample Solaris System Information File

In the following sample, *xx* represents the driver number:

```
[ODBC Data Sources]
Oracle7=Sample Oracle dsn
dBase=Sample dBASE dsn
Sybase=Sample Sybase dsn
Informix=Sample Infofrmix dsn
OpenIngres=Sample OpenIngres dsn
DB2=Sample DB2 dsn
Text=Sample Text file dsn

[dBase]
Driver=/opt/odbc/lib/ivdbfxx.so
Description=dBase
Database=/opt/odbc/demo
```

```
[Sybase]
Driver=/opt/odbc/lib/ivsybxx.so
Description=Sybase
Database=odbc
ServerName=SYBASE
LogonID=odbc01
Password=odbc01
OptimizePrepare=2
SelectMethod=1

[Oracle7]
Driver=/opt/odbc/lib/ivor7xx.so
Description=Oracle7
ServerName=oraclehost
LogonID=odbc01
Password=odbc01

[Informix]
Driver=/opt/odbc/lib/ivinfxx.so
Description=Informix7
Database=odbc
HostName=informixhost
LogonID=odbc01
Password=odbc01

[DB2]
Driver=/opt/odbc/lib/ivdb2xx.so
Description=DB2
Database=ODBC

[OpenIngres]
Driver=/opt/odbc/lib/ivoingxx.so
ServerName=ingreshost
Database=odbc
LogonID=odbc01
Password=odbc01

[Text]
Driver=/opt/odbc/lib/ivtxtxx.so
Description=Text driver
Database=/opt/odbc/demo
```

```
[ODBC]
Trace=0
TraceFile=odbctrace.out
TraceDll=/opt/odbc/lib/odbctrac.so
InstallDir=/opt/odbc
```

Environment Variables

Connect ODBC drivers require several environment variables to be set.

Required Environment Variables

Most of the varibles can be set by executing the appropriate shell script located in the ODBC home directory.

For example, C shell (and related shell) users should execute the following command before attempting to use ODBC-enabled applications:

```
% source odbc.csh
```

Bourne shell (and related shell) users should initialize their environment as follows:

```
$ . odbc.sh
```

Executing these scripts will set the appropriate library search path environment variable (LD_LIBRARY_PATH on Solaris, SHLIB_PATH on HP/UX, or LIBPATH on AIX).

The library search path environment variables are required to be set so that the ODBC core components and drivers can be located at the time of execution.

Optional Environment Variables

Many of the Connect ODBC drivers must have environment variables set as required by the database client components used by the drivers. Consult the system requirements in each of the individual driver sections for additional information pertaining to individual driver requirements.

ODBCINI is an optional environment variable that all Connect ODBC drivers will recognize. ODBCINI is used to locate a system information file other than the default file and is described in detail under "The System Information File (.odbc.ini)" on page 457.

Using Double-Byte Character Sets

Connect ODBC drivers are capable of using double-byte character sets. The drivers normally use the character set defined by the default locale "C" unless explicitly pointed to another character set. The default locale "C" corresponds to the 7-bit ASCII character set in which only characters from ISO 8859-1 are valid. Use the following procedure to set the locale to a different character set.

1 Add the following line at the very beginning of applications that use double-byte character sets:

```
setlocale (LC_ALL, "");
```

This is a standard UNIX function. It selects the character set indicated by the environment variable LANG as the one to be used by X/Open compliant character handling functions. If this line is not present, or if LANG is either not set or is set to NULL, the default locale "C" is used.

2 Set the LANG environment variable to the appropriate character set. The UNIX command `locale -a` can be used to display all supported character sets on your system.

For more information, see the man pages for "locale" and "setlocale."

The ivtestlib Tool

The ivtestlib tool is provided to help diagnose configuration problems (such as environment variables not correctly set or missing DBMS client components) in the UNIX environment. This command will attempt to load a specified ODBC driver and will print out all available error information if the load fails.

On HP-UX, for example, if a driver is installed in /opt/odbc, the command:

```
ivtestlib /opt/odbc/lib/ivinfxx.sl
```

(where *xx* represents the driver number) will attempt to load the Informix driver. If the driver cannot be loaded, ivtestlib will return an error message explaining why.

Note: On Solaris and AIX, the full path to the driver does not have to be specified for ivtestlib. The HP-UX version of ivtestlib, however, requires the full path.

Translators

DataDirect provides a sample translator named "OEM to ANSI" that provides a framework for coding a translation library.

You must add the TranslationSharedLibrary keyword to the data source section of the system information file to perform a translation. Adding the TranslationOption keyword is optional.

Keyword	Definition
TranslationSharedLibrary	Full path of translation library
TranslationOption	ASCII representation of the 32-bit integer translation option

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