

Informix ODBC Driver Programmer's Manual

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In This Introduction

This introduction provides an overview of the information in this manual and describes the conventions it uses.

About This Manual

This manual is a user guide and reference manual for Informix ODBC Driver, which is the Informix implementation of the Microsoft Open Database Connectivity (ODBC) interface, Version 3.0. This manual explains how to use the Informix ODBC Driver application programming interface (API) to access an Informix database and interact with an Informix database server.

Types of Users

This manual is written for C programmers who are using Informix ODBC Driver to access Informix databases.

This manual assumes that you have the following background:

- A working knowledge of your computer, your operating system, and the utilities that your operating system provides
- Some experience working with relational or object-relational databases, or exposure to relational database concepts
- C language programming

If you have limited experience with relational databases, SQL, or your operating system, refer to the [Getting Started](#) manual for your database server for a list of supplementary titles.

Software Dependencies

This manual assumes that you are using Informix ODBC Driver, Version 3.3, on either a UNIX or a Windows NT, Windows 95, or Windows 98 platform.

In places where this manual presents database server-specific information, this information applies to one of the following database servers:

- Informix Dynamic Server
- Informix Dynamic Server with Advanced Decision Support and Extended Parallel Options
- Informix Dynamic Server with Universal Data Option
- Informix Dynamic Server, Workgroup Edition
- INFORMIX-SE

If you are using a database server that is not listed here, see your release notes for information about client behavior on your database server.

Assumptions About Your Locale

Informix products can support many languages, cultures, and code sets. All culture-specific information is brought together in a single environment, called a Global Language Support (GLS) locale.

The examples in this manual are written with the assumption that you are using the default locale **en_us.8859-1** for UNIX and **en_us.1252** for Windows. This locale supports U.S. English format conventions for dates, times, and currency. In addition, this locale supports the ISO 8859-1 code set, which includes the ASCII code set plus many 8-bit characters such as é, è, and ñ.

If you plan to use nondefault characters in your data or your SQL identifiers, or if you want to conform to the nondefault collation rules of character data, you need to specify the appropriate nondefault locale.

For instructions on how to specify a nondefault locale, additional syntax, and other considerations related to GLS locales, see the [Informix Guide to GLS Functionality](#).

Demonstration Databases

The demonstration files that you receive with Informix ODBC Driver contain demonstration source programs and files that create, populate, and drop the **odbc_demo** database. You can find the demonstration files in the following locations.

UNIX

On UNIX (Solaris), the ODBC demonstration files are located at:

```
$INFORMIXDIR/demo/clidemo
```



Windows

In Windows, the ODBC demonstration files are located at:

```
%INFORMIXDIR%\demo\odbcdemo
```



The **readme.txt** file in each of these locations describes each of the demonstration files and its purpose. Some of the demonstration program source code is also provided as example text in the manual.

New Features

Informix ODBC Driver, Version 3.3, is a new product that replaces INFORMIX-CLI, Version 2.8. Informix ODBC Driver implements the Microsoft Open Database Connectivity (ODBC) Version 3.0 standard.

New features in Informix ODBC Driver include:

- Data Source Name (DSN) migration
- Extended data types, including rows and collections ◆
- Driver Manager Replacement Module, which supports compatibility between ODBC 2.x applications and the ODBC 3.3 driver ◆
- Long identifiers
- GLS data types
- Limited support of bookmarks
- Extensive error detection

IDS/UD

UNIX

UNIX

INFORMIX-Client Software Developer’s Kit, Version 2.3, supports silent installation in UNIX environments. The installation script includes additional options that allow you to override version checking, so that the installation can proceed without further user interaction. ♦

Documentation Conventions

This section describes the conventions that this manual uses. These conventions make it easier to gather information from this and other volumes in the documentation set.

The following conventions are discussed:

- Typographical conventions
- Icon conventions
- Sample-code conventions

Typographical Conventions

This manual uses the following conventions to introduce new terms, illustrate screen displays, describe command syntax, and so forth.

Convention	Meaning
KEYWORD	All primary elements in a programming language statement (keywords) appear in uppercase letters in a serif font.
<i>italics</i> italics <i>italics</i>	Within text, new terms and emphasized words appear in italics. Within syntax and code examples, variable values that you are to specify appear in italics.
boldface boldface	Names of program entities (such as classes, events, and tables), environment variables, file and pathnames, and interface elements (such as icons, menu items, and buttons) appear in boldface.
monospace <i>monospace</i>	Information that the product displays and information that you enter appear in a monospace typeface.

(1 of 2)



Convention	Meaning
KEYSTROKE	Keys that you are to press appear in uppercase letters in a sans serif font.
◆	This symbol indicates the end of one or more product- or platform-specific paragraphs.
→	This symbol indicates a menu item. For example, “Choose Tools→Options ” means choose the Options item from the Tools menu.

(2 of 2)

Tip: When you are instructed to “enter” characters or to “execute” a command, immediately press RETURN after the entry. When you are instructed to “type” the text or to “press” other keys, no RETURN is required.

Icon Conventions

Throughout the documentation, you will find text that is identified by several different types of icons. This section describes these icons.

Comment Icons

Comment icons identify three types of information, as the following table describes. This information always appears in italics.

Icon	Label	Description
	Warning:	Identifies paragraphs that contain vital instructions, cautions, or critical information
	Important:	Identifies paragraphs that contain significant information about the feature or operation that is being described
	Tip:	Identifies paragraphs that offer additional details or shortcuts for the functionality that is being described

Feature, Product, and Platform Icons

Feature, product, and platform icons identify paragraphs that contain feature-specific, product-specific, or platform-specific information.

Icon	Description
	Identifies information that relates to ODBC interface conformance The Core level is the minimum level to which all ODBC drivers are expected to conform.
	Identifies information that relates to the Informix Global Language Support (GLS) feature
	Identifies information that is specific to Informix Dynamic Server and Informix Dynamic Server, Workgroup Edition
	Identifies information that is specific to Informix Dynamic Server with Universal Data Option
	Identifies information that is specific to Informix Dynamic Server and Informix Dynamic Server with Universal Data Option
	Identifies information that relates to ODBC interface conformance Level 1 includes the core standards compliance level functionality and some additional features, including scrollable cursors, bookmarks, and positioned updates and deletes.
	Identifies information that relates to ODBC interface conformance Level 2 includes the Level 1 standards compliance level functionality and some additional features, including bookmark update, delete, and refresh; stored procedure support; catalog functions for primary and foreign keys; and multicatalog support.

(1 of 2)

Icon	Description
	Identifies information that is specific to UNIX platforms
	Identifies information that is specific to the Windows NT environment
	Identifies information that is specific to Windows NT, Windows 95, and Windows 98 environments

(2 of 2)

These icons can apply to an entire section or to one or more paragraphs within a section. If an icon appears next to a section heading, the information that applies to the indicated feature, product, or platform ends at the next heading at the same or higher level. A ♦ symbol indicates the end of feature-, product-, or platform-specific information that appears within one or more paragraphs within a section.

Sample-Code Conventions

Examples of SQL code occur throughout this manual. Except where noted, the code is not specific to any single Informix application development tool. If only SQL statements are listed in the example, they are not delimited by semicolons. For instance, you might see the code in the following example:

```
CONNECT TO sales_demo
:
DELETE FROM customer
      WHERE customer_num = 121
:
COMMIT WORK
DISCONNECT CURRENT
```

To use this SQL code for a specific product, you must apply the syntax rules for that product. For example, if you are using DB-Access, you must delimit multiple statements with semicolons. If you are using an SQL API, you must use EXEC SQL at the start of each statement and a semicolon (or other appropriate delimiter) at the end of the statement.



Tip: Ellipsis points in a code example indicate that more code would be added in a full application, but it is not necessary to show it to describe the concept being discussed.

For detailed directions on using SQL statements for a particular application development tool or client product, see the manual for your product.

Additional Documentation

For additional information, you might want to refer to the following documentation:

- On-line manuals
- Printed manuals
- On-line help
- Error message documentation
- Documentation Notes, Release Notes, Machine Notes
- Related reading
- *Microsoft ODBC 3.0 Programmer's Reference*

On-Line Manuals

An Answers OnLine CD that contains Informix manuals in electronic format is provided with your Informix products. You can install the documentation or access it directly from the CD. For information about how to install, read, and print on-line manuals, see the installation insert that accompanies Answers OnLine.

Printed Manuals

To order printed manuals, call 1-800-331-1763 or send email to moreinfo@informix.com. Please provide the following information when you place your order:

- The documentation that you need
- The quantity that you need
- Your name, address, and telephone number

Windows

On-Line Help

Informix provides on-line help with each graphical user interface (GUI) that displays information about those interfaces and the functions that they perform. Use the help facilities that each GUI provides to display the on-line help.

Error Message Documentation

Informix software products provide ASCII files that contain all of the Informix error messages and their corrective actions.

To read error messages and corrective actions on UNIX, use one of the following utilities.

Utility	Description
finderr	Displays error messages on line
rofferr	Formats error messages for printing

◆

Windows

To read error messages and corrective actions in Windows environments, use the **Informix Find Error** utility. To display this utility, choose **Start→Programs→Informix** from the Task Bar. ◆

Instructions for using the preceding utilities are available in Answers OnLine. Answers OnLine also provides a listing of error messages and corrective actions in HTML format.

UNIX

Documentation Notes, Release Notes, Machine Notes

In addition to printed documentation, the following sections describe the on-line files that supplement the information in this manual. Please examine these files before you begin using your database server and client products. They contain vital information about application and performance issues.

On UNIX platforms, the following on-line files appear in the `$INFORMIXDIR/release/en_us/0333` directory.

On-Line Files	Descriptions
Documentation Notes	This item includes additions or corrections to the manual and information about features that might not be covered in the manual or that have been modified since publication. The documentation notes for this product are provided in HTML and ASCII text versions.
Release Notes	This item describes feature differences from earlier versions of Informix products and how these differences might affect current products. This file also contains information about any known problems and their workarounds. The release notes file for Client SDK includes information about database server compatibility. The release notes for this product are provided in HTML and ASCII text versions.
Machine Notes	The machine notes file describes any special actions that you must take to configure and use Informix products on your computer.



Windows

The following items appear in the **Informix** folder. To display this folder, choose **Start→Programs→Informix** from the Task Bar.

Program Group Item	Description
Documentation Notes	This item includes additions or corrections to manuals and information about features that might not be covered in the manuals or that have been modified since publication.
Release Notes	This item describes feature differences from earlier versions of Informix products and how these differences might affect current products. This file also contains information about any known problems and their workarounds. The release notes file for Client SDK includes information about database server compatibility.

Machine notes do not apply to Windows environments. ♦

Related Reading

The following publications provide additional information about the topics that this manual discusses. For a list of publications that provide an introduction to database servers and operating-system platforms, refer to your [Getting Started](#) manual.

- INFORMIX-Client Software Developer's Kit, Version 2.3
- Microsoft ODBC 3.0 Software Development Kit and Programmer's Reference (ISBN Number 1-57231-516-4)

Compliance with Industry Standards

Informix ODBC Driver is based on Version 3.0 of the Microsoft Open Database Connectivity specification, which in turn is based on the X/Open Group SQL Access Call Level Interface (CLI) specification. The ODBC and CLI specifications provide a common and open interface through which American National Standards Institute (ANSI) compliant SQL is passed.

Informix Welcomes Your Comments

Let us know what you like or dislike about our manuals. To help us with future versions of our manuals, we want to know about any corrections or clarifications that you would find useful. Include the following information:

- The name and version of the manual that you are using
- Any comments that you have about the manual
- Your name, address, and phone number

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The **doc** alias is reserved exclusively for reporting errors and omissions in our documentation.

We appreciate your suggestions.

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In This Chapter

This chapter introduces Informix ODBC Driver, Version 3.3, and describes its advantages and architecture. The chapter also describes conformance, isolation and lock levels, libraries, and environment variables.

What Is Informix ODBC Driver?

Open Database Connectivity (ODBC) is a specification for a database Application Programming Interface (API). Microsoft ODBC, Version 3.0, is based on the Call Level Interface specifications from X/Open and the International Standards Organization/International Electromechanical Commission (ISO/IEC). ODBC supports SQL statements with a library of C functions. An application calls these functions to implement ODBC functionality.

ODBC applications enable you to perform the following operations:

- Connect to and disconnect from data sources
- Retrieve information about data sources
- Retrieve information about Informix ODBC Driver
- Set and retrieve Informix ODBC Driver options
- Prepare and send SQL statements
- Retrieve SQL results and process the results dynamically
- Retrieve information about SQL results and process the information dynamically

ODBC lets you allocate storage for results before or after the results are available. This feature lets you determine the results and the action to take without the limitations that predefined data structures impose.

ODBC does not require a preprocessor to compile an application program.

UNIX

Windows

IDS/UD



Informix ODBC Driver Features

Informix ODBC Driver implements the Microsoft Open Database Connectivity (ODBC) Version 3.0 standard. The Informix ODBC Driver product also provides the following features and functionality:

- Data Source Name (DSN) migration
- Driver Manager Replacement Module, which supports compatibility between ODBC 2.x applications and the ODBC 3.3 driver ♦
- Microsoft Transaction Server (MTS), which is an environment that lets you develop, run, and manage scalable, component-based Internet and intranet server applications. MTS performs the following tasks:
 - Manages system resources, including processes, threads, and database connections, so that your application can scale to many simultaneous users
 - Manages server component creation, execution, and deletion
 - Automatically initiates and controls transactions to make your application reliable
 - Implements security so that unauthorized users cannot access your application
 - Provides tools for configuration, management, and deployment ♦
- Extended data types, including rows and collections ♦
- Long identifiers
- Limited support of bookmarks
- GLS data types
- Extensive error detection

Warning: *There are minor differences, such as text box names, between the Informix ODBC Driver versions for Windows 95, Windows 98, and Windows NT.*

Support for Extended Data Types

Informix ODBC Driver supports the following extended data types:

- Collection (LIST, MULTISSET, SET)
- DISTINCT
- OPAQUE (fixed, unnamed)
- Row (named, unnamed)
- Smart large object (BLOB, CLOB)
- Client functions to support some of the extended data types ♦

Support for GLS Data Types

Informix ODBC Driver supports the following GLS data types:

- NCHAR
- NVCHAR

For more information on data types, see [Chapter 4, “Data Types.”](#)

Extended Error Detection

Informix ODBC Driver detects the following types of errors:

- ISAM
- XA

IDS/UD

IDS & IDS/UD

Windows

Additional Values for Some ODBC Function Arguments

Informix ODBC Driver supports additional values for some ODBC function arguments including:

- *fDescType* values for **SQLColAttributes**
 - ❑ SQL_INFX_ATTR_FLAGS
 - ❑ SQL_INFX_ATTR_EXTENDED_TYPE_ALIGNMENT
 - ❑ SQL_INFX_ATTR_EXTENDED_TYPE_CODE
 - ❑ SQL_INFX_ATTR_EXTENDED_TYPE_NAME
 - ❑ SQL_INFX_ATTR_EXTENDED_TYPE_OWNER
 - ❑ SQL_INFX_ATTR_SOURCE_TYPE_CODE
- *fInfoType* return value for **SQLGetInfo**
 - ❑ SQL_INFX_LO_PTR_LENGTH
 - ❑ SQL_INFX_LO_SPEC_LENGTH ♦
- SQL_INFX_LO_STAT_LENGTH ♦
- *fOption* value for **SQLGetConnectOption** and **SQLSetConnectOption**: SQL_INFX_OPT_LONGID ♦
- *fOption* value for **SQLGetConnectOption** and **SQLSetConnectOption**: SQL_ATTR_ENLIST_IN_DTC ♦

Informix ODBC Driver Architecture

ODBC with the Informix ODBC Driver can include the following components:

- Driver manager
An application can link to a driver manager, which links to the driver specified by the data source. The driver manager also checks parameters and transitions. The following table describes the driver-manager requirements and options for each platform.

Platform	Driver Manager
UNIX	A driver manager is optional. You can purchase a UNIX driver manager from a third-party vendor.
Windows	Informix ODBC Driver provides the driver manager, which is mandatory.

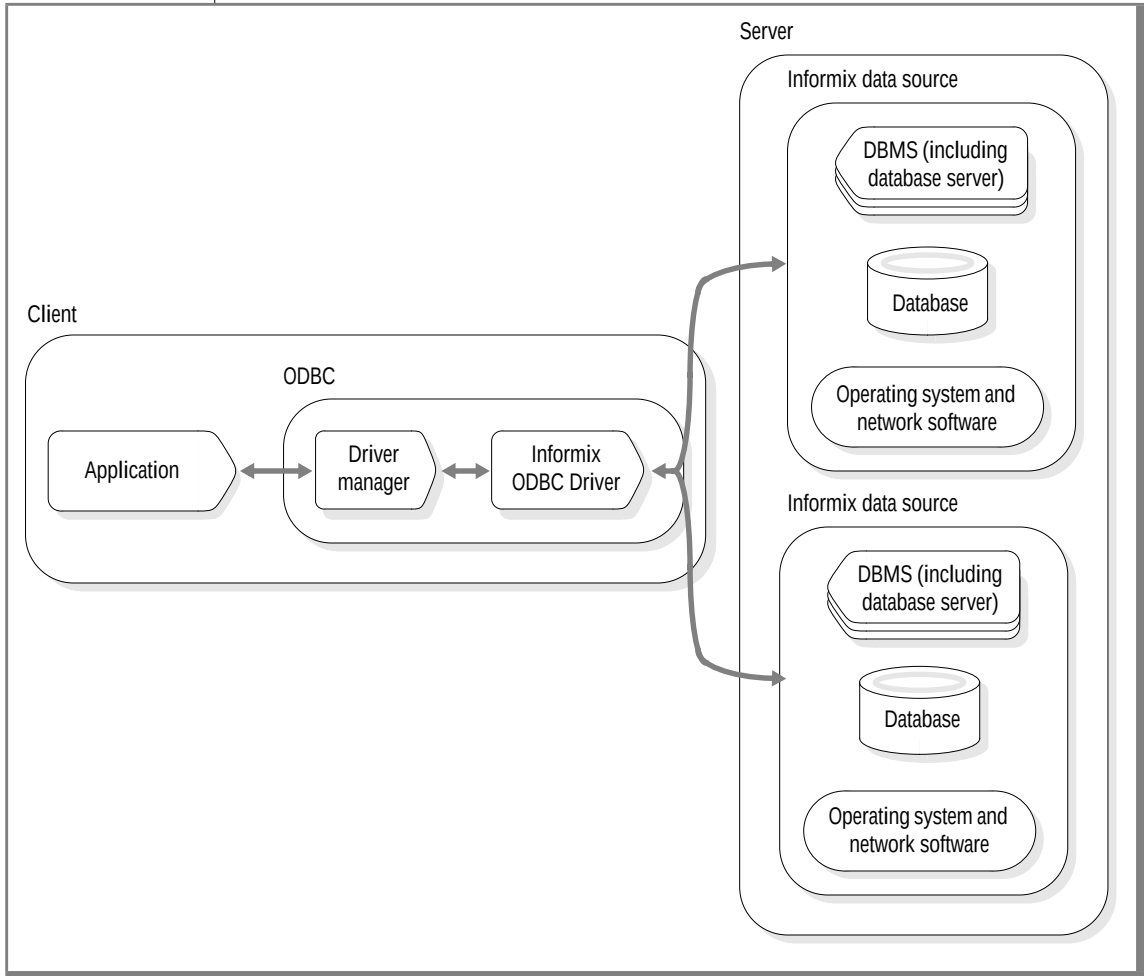
- Informix ODBC Driver
The driver provides an interface between an Informix database server and either a driver manager or an application, depending on whether or not the system architecture includes a driver manager. If a driver manager is not included, Informix ODBC Driver performs the driver-manager functions.
- Data sources

Informix ODBC Driver with a Driver Manager

Figure 1-1 shows the software architecture when a driver manager is included in the system. In such a system, the driver and driver manager act like a single unit that processes function calls.

Figure 1-1

Informix ODBC Driver with a Driver Manager

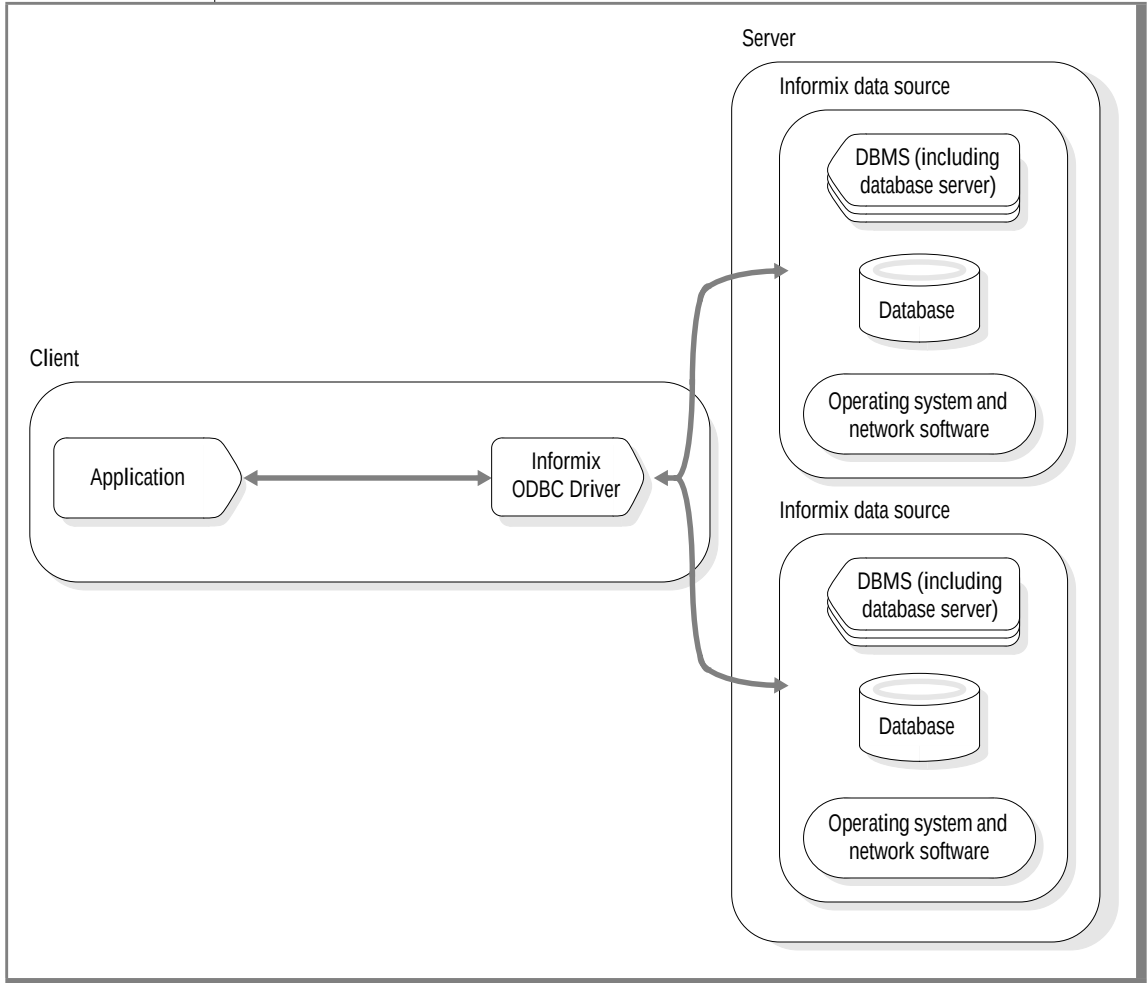


UNIX

Informix ODBC Driver Without a Driver Manager

Figure 1-2 shows an application using Informix ODBC Driver without a driver manager. In this case, the application must link to the Informix ODBC Driver library. For more information, see [“Libraries” on page 1-14](#).

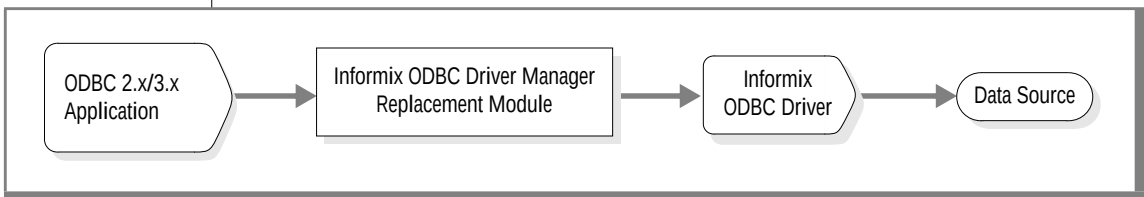
Figure 1-2
Informix ODBC Driver Without a Driver Manager



Informix ODBC Driver with the DMRM

Informix ODBC Driver includes a Driver Manager Replacement Module (DMRM), which is also known as the Driver Manager Replacement (DMR) library. The DMRM replaces the driver manager on platforms where no driver manager is available. [Figure 1-3](#) shows an ODBC configuration with the DMRM.

Figure 1-3
Architecture of the Driver Manager Replacement Module



Applications that are linked directly to the ODBC 3.0 driver and the DMRM do not require the ODBC Driver Manager.

In addition to supporting ODBC 3.0 features, the DMRM supports compatibility between ODBC 2.x applications and Version 3.3 of the Informix ODBC Driver. To be compatible with ODBC 2.x applications, the application must link to Version 3.3 of Informix ODBC Driver through the DMRM or through the ODBC 3.0 driver manager.

You cannot use the DMRM to connect to different data sources. The DMRM does not support connection pooling because it is a subset of a driver manager that is designed to work specifically with an Informix data source.

Data Sources

A data source consists of the following components:

- A database management system (DBMS), including a database server
- A database
- The operating system and network software necessary for accessing the database

Informix ODBC Driver accesses Informix data sources.

Using Informix ODBC Driver

Informix ODBC Driver includes the following components:

- Environment variables
- Header files
- Data types
- Libraries

Environment Variables

The following table describes environment variables that you must set for the driver. For more information about environment variables, see the [Informix Guide to SQL: Reference](#).

Environment Variable	Description
INFORMIXDIR (UNIX)	Full path of the directory where the INFORMIX-Client Software Developer's Kit is installed. On Windows platforms, INFORMIXDIR is a registry setting rather than an environment variable. It is set during installation.
PATH	Directories that are searched for executable programs. Your PATH setting must include the path to your \$INFORMIXDIR/bin directory.
DBCENTURY (optional)	Controls the setting of year values. DBCENTURY affects a client program when a user issues a statement that contains a date or datetime string that specifies only the last two digits of the year. For example: <pre>insert into datetable (datecol) values ("01/01/01");</pre> The database server stores the date specified in this statement as either 01-01-1901 or 01-01-2001, depending on the DBCENTURY value on the client.
DBDATE or GL_DATE (optional)	DBDATE and GL_DATE control the interpretation of dates. For example, you can specify whether the date format is <i>mm-dd-yyyy</i> or <i>yyyy-mm-dd</i> .

UNIX

Setting Environment Variables on UNIX

If you set these environment variables at the command line, you must reset them whenever you log onto your system. If you set these environment variables in a file, they are set automatically when you log onto your system.

Informix ODBC Driver provides a sample setup file called **setup.odbc** in **\$INFORMIXDIR/etc**. You can use this file to set environment variables for the driver. The following table describes the environment variables that are in **setup.odbc**.

Environment Variable	Description
INFORMIXDIR	Full path of the directory where the INFORMIX-Client Software Developer's Kit is installed
INFORMIXSQLHOSTS	This value is optional. It specifies the directory that contains sqlhosts . By default, sqlhosts is in \$INFORMIXDIR/etc . Set INFORMIXSQLHOSTS if you want sqlhosts to be in a different directory.
ODBCINI	This value is optional. You can use it to specify an alternative location for the odbc.ini file. The default location is your home directory.

Windows

Setting Environment Variables in Windows

If you set the environment variables at the command line, you must reset them whenever you log into your Windows environment. If you set them in the Windows registry, however, they are set automatically when you log in. Informix ODBC Driver stores environment variables in the following location in the Windows registry:

\\HKEY_CURRENT_USERS\\Software\\Informix\\Environment

In a Windows environment you must use **setnet32.exe**, or a tool that will update the registry correctly, to set environment variables that Informix dynamic link libraries (DLLs), such as **iclit09b.dll**, use.

You can use environment variables as required by your development environment. For example, the compiler needs to know where to find include files. To specify the location of include files, set the environment variable **INFORMIXDIR** (or some other environment variable) and then set the include path to **INFORMIXDIR\incl\cli**.

Header Files

You can use the **sql.h** and **sqlext.h** header files, which are part of the Microsoft compiler, to run Informix ODBC Driver. To run Informix extensions, include the **infxcli.h** file, which is installed in **INFORMIXDIR/incl/cli**. This file defines Informix ODBC Driver constants and types, and provides function prototypes for the Informix ODBC Driver functions. If you include the **infxcli.h** file, it automatically includes the **sql.h** and **sqlext.h** files.

The **sql.h** and **sqlext.h** header files contain definitions of the C data types. For more information about data types, see [Chapter 4](#).

Data Types

A column of data stored on a data source has an SQL data type. Informix ODBC Driver maps Informix-specific SQL data types to ODBC SQL data types, which are defined in the ODBC SQL grammar. (The driver returns these mappings through **SQLGetTypeInfo**. It also uses the ODBC SQL data types to describe the data types of columns and parameters in **SQLColAttributes** and **SQLDescribeCol**).

Each SQL data type corresponds to an ODBC C data type. By default, the driver assumes that the C data type of a storage location corresponds to the SQL data type of the column or parameter to which the location is bound. If the C data type of a storage location is not the *default* C data type, the application can specify the correct C data type with the *TargetType* argument for **SQLBindCol**, the *fCType* argument for **SQLGetData**, and the *ValueType* argument in **SQLBindParameter**. Before the driver returns data from the data source, it converts the data to the specified C data type. Before the driver sends data to the data source, it converts the data from the specified C data type to the SQL data type.

The Informix data type names differ from the Microsoft ODBC data type names. For information about these differences, refer to [Chapter 4, “Data Types”](#) and to the appendix on data types in the *Microsoft ODBC 3.0 Programmer’s Reference*.

Libraries

The installation procedure installs the following libraries into **INFORMIXDIR/lib/cli**. In each Data Source specification section in the **odbc.ini** file, set the driver value to one of the following library filenames.

Filename	Description
libifcli.a or libcli.a	Static version for single (nonthreaded) library
libifcli.so or iclis09b.so	Shared version for single (nonthreaded) library
libthcli.a	Static version for multithreaded library
libthcli.so or iclit09b.so	Shared version for multithreaded library
libifdrmr.so or idmrs09a.so	Shared library for DMR (thread safe)

For more information about the **odbc.ini** file, see [“The odbc.ini File” on page 2-6](#).

If you do not use a driver manager, your application needs to link to either the static or the shared version of the Informix ODBC Driver libraries.

The following compile command links an application to the thread-safe version of the Informix ODBC Driver libraries:

```
cc ... -L$INFORMIXDIR/lib/cli -lifdmr - lifcli
```

◆

Windows

The installation procedure installs the following libraries into **INFORMIXDIR\lib**.

Filename	Description
iclit09b.lib	Enables linking directly to the driver without the use of a driver manager
iregt07b.lib	Allows linking directly to iregt07b.dll



If you use a driver manager, you must link your application to the driver manager library only, as the following example shows:

```
cc ... -L$INFORMIXDIR/lib/cli -lodbc
```

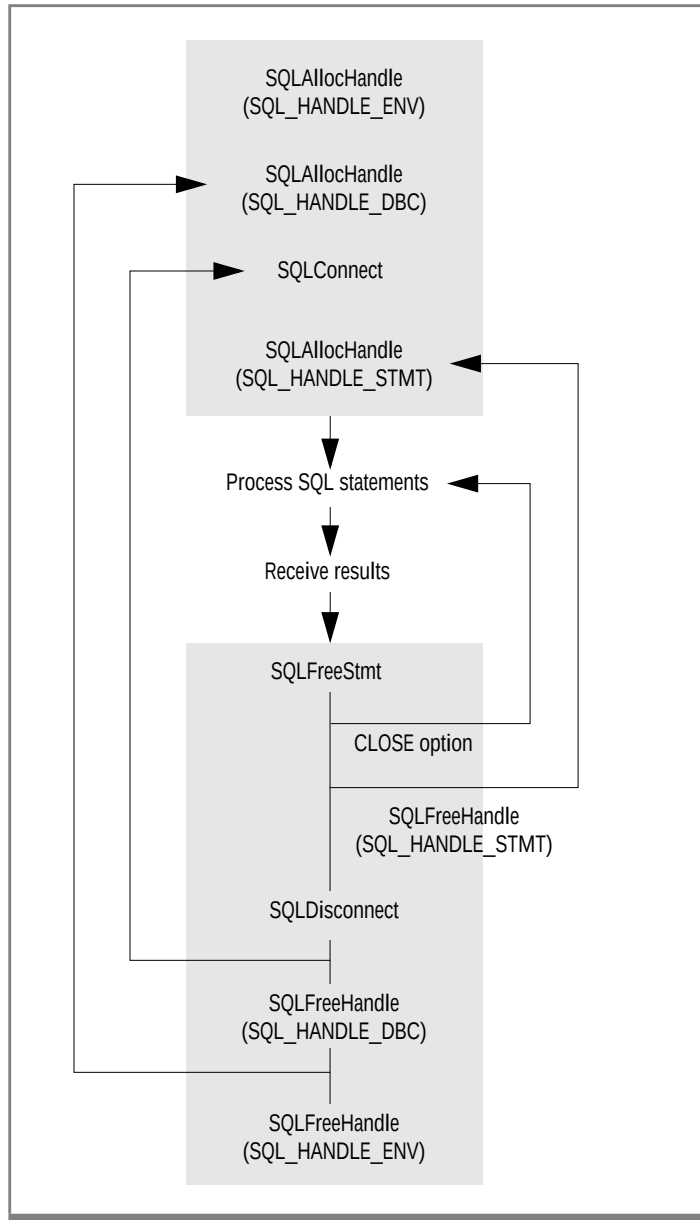
Informix ODBC Driver requires a Version 3.0 driver manager.

Using the Informix ODBC Driver API

An application uses the Informix ODBC Driver API to make a connection to a data source, send SQL statements to a data source, process result data dynamically, and terminate a connection. The driver enables your application to perform the following steps:

1. Connect to the data source.
You can connect to the data source through a DSN connection, or you can use DSN-less connection strings. Specify the data-source name and any additional information needed to complete the connection.
2. Process one or more SQL statements:
 - a. Place the SQL text string in a buffer. If the statement includes parameter markers, set the parameter values.
 - b. If the statement returns a result set, either assign a cursor name for the statement or let the driver assign one.
 - c. Either prepare the statement or submit it for immediate execution.

Figure 1-4
Sample Listing of
Function Calls That
an Informix ODBC
Driver Application
Makes



Environment, Connection, and Statement Handles

When an application requests it, the driver and the driver manager allocate storage for information about the environment, each connection, and each SQL statement. The driver returns a handle for each of these allocations to the application, which uses one or more handles in each call to a function.

The INFORMIX ODBC Driver API uses the following types of handles:

- **Environment handles.** Environment handles identify memory storage for global information, including the valid connection handles and the current active connection handle. The environment handle is an HENV variable type. An application uses one environment handle. It must request this handle before it connects to a data source.
- **Connection handles.** Connection handles identify memory storage for information about particular connections. A connection handle is an HDBC variable type. An application must request a connection handle before it connects to a data source. Each connection handle is associated with the environment handle. However, the environment handle can be associated with multiple connection handles.
- **Statement handles.** Statement handles identify memory storage for information about SQL statements. A statement handle is an HSTMT variable type. An application must request a statement handle before it submits SQL requests. Each statement handle is associated with exactly one connection handle. However, each connection handle can be associated with multiple statement handles.

Buffers

An application passes data to the driver in an input buffer. The driver returns data to the application in an output buffer. The application must allocate memory for both input and output buffers. If the application uses the buffer to retrieve string data, the buffer must contain space for the null termination byte.

Some functions accept pointers to buffers that are used later by other functions. The application must ensure that these pointers remain valid until all applicable functions have used them. For example, the argument *rgbValue* in **SQLBindCol** points to an output buffer where **SQLFetch** returns the data for a column.

Input Buffers

An application passes the address and length of an input buffer to the driver. The length of the buffer must be one of the following values:

- A length greater than or equal to zero
This value is the actual length of the data in the input buffer. For character data, a length of zero indicates that the data is an empty (zero length) string. A length of zero is different from a null pointer. If the application specifies the length of character data, the character data does not need to be null-terminated.
- SQL_NTS
This value specifies that a character data value is null-terminated.
- SQL_NULL_DATA
This value tells the driver to ignore the value in the input buffer and use a NULL data value instead. It is valid only when the input buffer provides the value of a parameter in an SQL statement.

For character data that contains embedded null characters, the operation of Informix ODBC Driver functions is undefined; for maximum interoperability, it is better not to use them. Informix database servers treat null characters as end-of-string markers or as indicators that no more data exists.

Unless it is specifically prohibited in a function description, the address of an input buffer can be a null pointer. In such cases, the value of the corresponding buffer-length argument is ignored. For more information about input buffers, see [“Converting Data from SQL to C” on page 4-24](#).

Output Buffers

An application passes the following arguments to the driver so that the driver can return data in an output buffer:

- The address of the output buffer, to which the driver returns the data
Unless it is specifically prohibited in a function description, the address of an output buffer can be a null pointer. In such cases, the driver does not return anything in the buffer and, in the absence of other errors, returns `SQL_SUCCESS`.

If necessary, the driver converts data before returning it. The driver always null-terminates character data before returning it.

- The length of the buffer
The driver ignores this value if the returned data has a fixed length in C, as with an integer, real number, or date structure.
- The address of a variable in which the driver returns the length of the data (the length buffer)

The returned length of the data is `SQL_NULL_DATA` if the data is a NULL value in a result set. Otherwise, the returned length of the data is the number of bytes of data that are available to return. If the driver converts the data, the returned length of the data is the number of bytes that remain after the conversion; for character data, it does not include the null-termination byte that the driver adds.

If the output buffer is too small, the driver attempts to truncate the data. If the truncation does not cause a loss of significant data, the driver returns the truncated data in the output buffer, returns the length of the available data (as opposed to the length of the truncated data) in the length buffer, and returns `SQL_SUCCESS_WITH_INFO`. If the truncation causes a loss of significant data, the driver leaves the output and length buffers untouched and returns `SQL_ERROR`. The application calls **SQLGetDiagRec** to retrieve information about the truncation or the error.

For more information about output buffers, see [“Converting Data from SQL to C” on page 4-24](#).

SQLGetInfo Argument Implementation

The following table describes the Informix implementation of **SQLGetInfo** arguments for Informix ODBC Driver. For more information on **SQLGetInfo**, see the *Microsoft ODBC 3.0 Programmer's Reference* and [“SQLGetInfo” on page 9-60](#).

Argument Name	Informix Implementation
SQL_ACTIVE_ENVIRONMENTS	Informix driver does not have a limit on number of active environments. Zero will always be returned.
SQLAggregate_FUNCTIONS	Informix driver will return all aggregate functions that the database server supports.
SQL_ASYNC_MODE	Informix driver will return SQL_AM_NONE.
SQL_ATTR_METADATA_ID	Supported for GetInfo and PutInfo
SQL_BATCH_ROW_COUNT	Informix driver will return bitmask zero.
SQL_BATCH_SUPPORT	Informix driver will return bitmask zero.
SQL_CA1_POS_DELETE	Operation arguments supported in a call to SQLSetPos
SQL_CA1_POS_POSITION	Operation arguments supported in a call to SQLSetPos
SQL_CA1_POS_REFRESH	Operation arguments supported in a call to SQLSetPos
SQL_CA1_POS_UPDATE	Operation arguments supported in a call to SQLSetPos
SQL_CA1_POSITIONED_DELETE	A DELETE WHERE CURRENT OF SQL statement is supported when the cursor is a forward-only cursor. (An SQL-92 entry-level-conforming driver will always return this option as supported.)
SQL_CA1_POSITIONED_UPDATE	An UPDATE WHERE CURRENT OF SQL statement is supported when the cursor is a static-only cursor. (An SQL-92 entry-level-conforming driver will always return this option as supported.)

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Argument Name	Informix Implementation
SQL_CA1_LOCK_NO_CHANGE	A LockType argument of SQL_LOCK_NO_CHANGE is supported in a call to SQLSetPos when the cursor is a static-only cursor.
SQL_CA1_SELECT_FOR_UPDATE	A SELECT FOR UPDATE SQL statement is supported when the cursor is a forward-only cursor. (An SQL-92 entry-level-conforming driver will always return this option as supported.)
SQL_CATALOG_NAME	Informix driver will return 'Y'
SQL_COLLATION_SEQ	INTERSOLV DataDirect ODBC Driver returns InfoValuePtr (unmodified)
SQL_DDL_INDEX	Returns bitmask SQL_DL_CREATE_INDEX SQL_DL_DROP_INDEX
SQL_DESCRIBE_PARAMETER	Returns 'N'; parameters cannot be described. (This is because the latest Informix database servers support function overloading such that multiple functions with the same name can accept different parameter types.)
SQL_DIAG_DYNAMIC_FUNCTION	Returns empty string
SQL_DROP_TABLE	Returns bitmask SQL_DT_DROP_TABLE SQL_DT_CASCADE SQL_DT_RESTRICT
SQL_DROP_VIEW	Returns bitmask SQL_DV_DROP_TABLE SQL_DV_CASCADE SQL_DV_RESTRICT
SQL_INDEX_KEYWORDS_	SQL_LK_ASC SQL_LK_DESC
SQL_INSERT_STATEMENT	Returns bitmask SQL_IS_INSERT_LITERALS SQL_INSERT_SEARCHED SQL_IS_SELECT_INTO
SQL_MAX_DRIVER_CONNECTIONS	Returns zero
SQL_MAX_IDENTIFIER_LEN	Returns different values, depending on database server capability
SQL_ODBC_INTERFACE_CONFORMANCE	Returns SQL_OIC_CORE
SQL_PARAM_ARRAY_ROW_COUNTS	Returns SQL_PARC_NO_BATCH

Argument Name	Informix Implementation
SQL_PARAM_ARRAY_SELECTS	Returns SQL_PAS_NO_SELECT
SQL_SQL_CONFORMANCE	Returns SQL_OSC_CORE
SQL_SQL92_FOREIGN_KEY_DELETE_RULE	Returns bitmask zero
SQL_SQL92_FOREIGN_KEY_UPDATE_RULE	Returns bitmask zero
SQL_SQL92_GRANT	Returns bitmask zero
SQL_SQL92_NUMERIC_VALUE_FUNCTIONS	Returns bitmask zero
SQL_SQL92_PREDICATES	Returns bitmask zero
SQL_SQL92_RELATIONAL_JOIN_OPERATORS	Returns bitmask zero
SQL_SQL92_REVOKE	SQL_SR_CASCADE SQL_SR_RESTRICT
SQL_SQL92_ROW_VALUE_CONSTRUCTOR	Returns bitmask zero
SQL_SQL92_STRING_FUNCTIONS	Returns bitmask zero
SQL_SQL92_VALUE_EXPRESSIONS	Returns bitmask zero
SQL_STANDARD_CLI_CONFORMANCE	Returns bitmask SQL_SCC_XOPEN_CLI_VERSION1 SQL_SCC_ISO92_CLI
SQL_STATIC_CURSOR_ATTRIBUTES1	Forward only
SQL_STATIC_CURSOR_ATTRIBUTES2	Forward only
SQL_XOPEN_CLI_YEAR	Returns string “1995”

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Global Language Support

Informix products can support many languages, cultures, and code sets. Global Language Support (GLS) provides support for all language- and culture-specific information. The following table describes how to set the GLS options depending on your platform.

Platform	How to Set GLS Options
UNIX	Specify the GLS options in the odbc.ini file. For more information, see “Configuring a New User or System DSN” on page 2-14 .
Windows	Specify the GLS options in the Informix ODBC Driver DSN Setup dialog box. For more information, see “Configuring a New User or System DSN” on page 2-14 .

The rest of this section describes the GLS options for Informix ODBC Driver. For more information about GLS and locales, see the [Informix Guide to GLS Functionality](#).

Client Locale

Description:	Locale and codeset that the application runs in
Format:	locale.codeset@modifier
odbc.ini field for UNIX:	CLIENT_LOCALE
Default value for UNIX:	en_us.8859-1
Default value for Windows:	en_us.1252

Database Locale

Description:	Locale and codeset that the database was created in
Format:	locale.codeset@modifier
odbc.ini field for UNIX:	DB_LOCALE
Default value for UNIX:	en_us.8859-1
Default value for Windows:	en_us.1252

Translation Library

Description:	Performs the codeset conversion
Format:	Path to the file for the library. The translation DLL must follow the ODBC standard for translation libraries. For more information, see the <i>Microsoft ODBC 3.0 Programmer's Reference</i> .
odbc.ini field for UNIX:	TRANSLATIONDLL
Default value for UNIX:	\$INFORMIXDIR/lib/esql/igo4a304.xx where xx is platform-specific extension for shared library
Default value for Windows:	igo4n304.dll

Translation Option

Description:	Option for a non-Informix translation library
Format:	Determined by the vendor
odbc.ini field for UNIX:	TRANSLATION_OPTION
Default value for Windows:	Determined by the vendor



Important: Do not set this option for an Informix translation library. An Informix translation library determines the translation option based on the client locale and database locale values.

VMC Character

Description: Varying multibyte character length reporting option that specifies how to set *pcbValue* when *rgbValue* (the output area) is not large enough for the code-set-converted data. The possible values are:

Estimate. Informix ODBC Driver makes a worst-case estimate of the storage space needed to return the data.

Exact. Informix ODBC Driver writes the code-set-converted data to disk until all the data is converted. Because this option can degrade performance, Informix recommends that you do not use this option unless your application does not work with **Estimate**.

When you use a multibyte code set (in which characters vary in length from 1 to 4 bytes) for either the database or client locale, the length of a character string or simple large object (TEXT) in the database locale does not indicate the length of the string after it is converted to the client locale.

Possible values for UNIX:	0 = Estimate 1 = Exact
Possible values for Windows:	Estimate Exact
odbc.ini field for UNIX:	VMBCHARLENEXACT
Default value for UNIX:	Estimate
Default value for Windows:	Estimate

Partially Supported and Unsupported ODBC Features

Informix ODBC Driver supports partial implementation of the following ODBC features:

- Transaction processing
- ODBC cursors
- ODBC bookmarks
- SQLBulkOperations
- SQLDescribeParam

Transaction Processing

Informix ODBC Driver implementation of transaction isolation levels and transaction modes is slightly different from the Microsoft ODBC implementation of these features. The following sections describe the implementation of transaction isolation levels and transaction modes in Informix ODBC Driver.

Transaction Isolation Levels

The following table lists the transaction isolation levels that Informix ODBC Driver supports for these Informix database servers.

Database Servers	Transaction Isolation Levels
Dynamic Server	■ SQL_TXN_READ_COMMITTED
Dynamic Server with UD Option	■ SQL_TXN_READ_UNCOMMITTED ■ SQL_TXN_SERIALIZABLE
Dynamic Server with AD and XP Options	■ SQL_TXN_READ_COMMITTED ■ SQL_TXN_READ_UNCOMMITTED ■ SQL_TXN_SERIALIZABLE Cursor stability. To use this isolation level, call SQLSetConnectOption() with the <i>fOption</i> value set to 1040 and <i>vParam</i> set to 1.

The default transaction isolation level is SQL_TXN_READ_COMMITTED. To change the transaction isolation level, call **SQLSetConnectOption()** with an *fOption* value of SQL_TXN_ISOLATION.

For more information about transaction isolation levels, see the SQL_DEFAULT_TXN_ISOLATION and SQL_TXN_ISOLATION_OPTION descriptions in the *Microsoft ODBC 3.0 Programmer's Reference*.

Transaction Modes

The default transaction mode is auto-commit.

To change the transaction mode to manual commit

1. Enable transaction logging for your database server.
For information about transaction logging, see your [Administrator's Guide](#).
2. Call **SQLSetConnectOption()** with SQL_AUTOCOMMIT set to SQL_AUTOCOMMIT_OFF.

ODBC Cursors

Informix ODBC Driver supports static and forward cursors but not dynamic and keyset-driven cursors.

For more information about cursors, see the *Microsoft ODBC 3.0 Programmer's Reference*.

ODBC Bookmarks

A *bookmark* is a value that identifies a row of data. Informix ODBC Driver supports bookmarks with **SQLFetchScroll** and **SQLExtendedFetch** and does not support them with **SQLBulkOperations**. Informix ODBC Driver supports bookmarks to the following extent:

- Uses only variable length bookmarks.
- SQL_DESC_OCTET_LENGTH is set to 4 for bookmark columns.
- A bookmark is an integer that contains the row number within the row set, starting with 1.
- Bookmarks persist only as long as the cursor remains open.
- **SQLFetchScroll**, using SQL_FETCH_BOOKMARK for the fetch orientation argument, is fully supported.
- **SQLBulkOperations** will not update the bookmark column for SQL_ADD.

For more information about ODBC bookmarks, see the *Microsoft ODBC 3.0 Programmer's Reference*.

SQLBulkOperations

Informix ODBC Driver supports only the SQL_ADD argument of **SQLBulkOperations**.

SQLDescribeParam

Use **SQLDescribeParam** when you are using a driver manager only.

Unsupported Microsoft ODBC Driver Features

Informix ODBC Driver does not support implementation of the following ODBC features:

- Asynchronous communication mode
- Concurrency checking
 - ❑ SQL_CA2_OPT_ROWVER_CONCURRENCY
 - ❑ SQL_CA2_OPT_VALUES_CONCURRENCY
- CONVERT scalar functions
- Cursor simulation features:
 - ❑ SQL_CA2_CRC_APPROXIMATE
 - ❑ SQL_CA2_CRC_EXACT
 - ❑ SQL_CA2_SIMULATE_NON_UNIQUE
 - ❑ SQL_CA2_SIMULATE_TRY_UNIQUE
 - ❑ SQL_CA2_SIMULATES_UNIQUE
- Dynamic cursor attributes
- Installer DLL
- SQL functions: **SQLSetStmtAttr**

- SQL statements:
 - ❑ SQL_ALTER_DOMAIN
 - ❑ SQL_ATTR_ASYNC_ENABLE
 - ❑ SQL_ATTR_AUTO_IPD
 - ❑ SQL_ATTR_CONNECT_TIMEOUT
 - ❑ SQL_ATTR_CURSOR_SENSITIVITY
 - ❑ SQL_CA1_LOCK_UNLOCK
 - ❑ SQL_CREATE_ASSERTION
 - ❑ SQL_CREATE_CHARACTER_SET
 - ❑ SQL_CREATE_COLLATION
 - ❑ SQL_CREATE_DOMAIN
 - ❑ SQL_CREATE_SCHEMA
 - ❑ SQL_CREATE_TRANSLATION
 - ❑ SQL_DESCRIBE_PARAMETERS
 - ❑ SQL_DM_VER
 - ❑ SQL_DROP_CHARACTER_SET
 - ❑ SQL_DROP_COLLATION
 - ❑ SQL_DROP_DOMAIN
 - ❑ SQL_DROP_SCHEMA
 - ❑ SQL_DROP_TRANSLATION
 - ❑ SQL_FORWARD_CURSOR_ATTRIBUTES
 - ❑ SQL_KEYSET_CURSOR_ATTRIBUTES
 - ❑ SQL_LOCK_EXCLUSIVE
 - ❑ SQL_LOCK_UNLOCK

Configuring Data Sources

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UNIX

In This Chapter

This chapter explains how to configure a data source (DSN) on UNIX and Windows for Informix ODBC Driver, Version 3.3. After you install the driver, you must configure your DSN before you can connect to it.

Important: *If you have INFORMIX-CLI, Version 2.8, or INTERSOLV DataDirect ODBC Driver, Version 3.11, installed on your computer, you must first use the procedures outlined in this chapter to transfer Informix ODBC Driver values to your DSN before using the migration procedures outlined in [Chapter 3](#).*

Configuring a DSN on UNIX

This section provides information on driver specifications and DSN specifications, and describes the following DSN configuration files:

- **sqlhosts**
- **odbcinst.ini**
- **odbc.ini**

The configuration files provide information, such as driver attributes, that the driver uses to connect to DSNs. To modify these files, use a text editor. The section also provides examples of driver and DSN specifications.

The sqlhosts File

This file consists of connection information. It contains an entry for each Informix database server. For information about **sqlhosts**, see your [Administrator's Guide](#).

The odbcinst.ini File

Installed ODBC drivers use the **odbcinst.ini** sample file, which is located in **\$INFORMIXDIR/etc/odbcinst.ini**. To create your **odbcinst.ini** file, copy the **odbcinst.ini** sample file to your home directory as **\$HOME/.odbcinst.ini** (note the added dot at the beginning of the filename). This file has entries for all the installed drivers on your computer. Update this file when you install a new driver or a new version of a driver. The following table describes section items in the **\$HOME/.odbcinst.ini** file.

Section	Description	Status
ODBC Drivers	List of names of all the installed ODBC drivers	Required
ODBC Driver Specifications	List of driver attributes and values	Required

ODBC Drivers

This section provides information on ODBC drivers.

The following example illustrates information about drivers:

```
[ODBC Drivers]
driver_name1=Installed
driver_name2=Installed
:
```

The following example illustrates information about installed drivers:

```
[ODBC Drivers]
INFORMIX 2.8 32 BIT=Installed
INFORMIX 3.3 32 BIT=Installed
```

Driver Specifications

Each installed driver has a properties section under the name of the driver. The following example illustrates a driver-specification format:

```
[driver_name1]
Driver=driver_library_path
Setup=setup/driver_library_path
APILevel=api_level_supported
ConnectFunctions=connectfunctions
DriverODBCVer=odbc_version
FileUsage=file_usage
SQLLevel=sql_level
:
```

The following example illustrates information about driver specifications:

```
[INFORMIX 3.3 32]
Driver=/vobs/tristarm/odbc/iclis09b.so
Setup=/vobs/tristarm/odbc/iclis09b.so
APILevel=1
ConnectFunctions=YYY
DriverODBCVer=03.30
FileUsage=0
SQLLevel=1
```

The following table describes the keywords that are in the driver-specification section.

Keywords	Description	Status
API Level	ODBC interface conformance level that the driver supports 0=None 1=Level 1 supported 2=Level 2 supported	Required
ConnectFunctions	Three-character string that indicates whether the driver supports SQLConnect, SQLDriverConnect, and SQLBrowseConnect	Required
DriverODBCVer	Character string with the version of ODBC that the driver supports	Required
Driver	Driver library path	Required

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Keywords	Description	Status
FileUsage	Number that indicates how a file-based driver directly treats files in a DSN	Required
Setup	Setup library	Required
SQLLevel	Number that indicates the SQL-92 grammar that the driver supports	Required

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For a detailed description of the Driver Specification section, see the *Microsoft ODBC 3.0 Programmer's Reference*.

The *odbc.ini* File

The **odbc.ini** file is a sample data-source configuration information file. For the location of **odbc.ini** file, see the release notes. To create this file, copy **odbc.ini** to your home directory as **\$HOME/.odbc.ini** (note the added dot at the beginning of the filename). Every DSN to which your application connects must have an entry in this file. The following table describes the sections in **\$HOME/.odbc.ini**.

Section	Description	Status
ODBC Data Sources	This section lists the DSNs and associates them with the name of the driver. You need to provide this section only if you use an ODBC driver manager from a third-party vendor.	Required
Data Source Specification	Each DSN listed in the ODBC Data Sources section has a Data-Source Specification section that describes the DSN.	Required

ODBC Data Sources

Each entry in the ODBC Data Sources section lists a DSN and the driver name. The *data_source_name* value is any name that you choose. It is like an envelope that contains all relevant connection information about the DSN.

The following example illustrates an ODBC data-source format:

```
[ODBC Data Sources]
data_source_name=INFORMIX ODBC 3.3 Driver
:
```

The following example defines two DSNs called EmpInfo and CustInfo:

```
[ODBC Data Sources]
EmpInfo=IINFORMIX ODBC 3.3 Driver
CustInfo=INFORMIX-CLI 2.8 Driver
```

Data-Source Specification

Each DSN in the data-sources section has a data-source specification section.

The following example illustrates a data-source specification format:

```
[data_source_name]
Driver=driver_path
Description=data_source_description
Database=database_name
LogonID=user_id
pwd=user_password
Server=database_server
CLIENT_LOCALE=application_locale
DB_LOCALE=database_locale
TRANSLATIONDLL=translation_path
VMBCHARLENEXACT=output_option
CURSORBEHAVIOR=cursor_behavior
```

The following table describes the keywords that are in the data-source specification section and the order that they appear in each section.

Keywords	Description	Status
data_source_name	Data source specified in the Data Sources section	Required
driver_path	Path for the driver Set this value to the complete pathname for the driver library. For more information on the library directory and filenames, see the release notes.	Required
data_source_description	Description of the DSN Configured for a single user or for system users.	Optional
database_name	Database to which the DSN connects by default	Required
user_id	User identification or account name for access to the DSN	Optional
user_password	Password for access to the DSN	Optional
database_server	Informix database server on which <i>database_name</i> resides	Required
application_locale (GLS only)	Client locale. Default value: en_us.8859-1	Optional

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Keywords	Description	Status
database_locale (GLS only)	Database locale. Default value: en_us.8859-1	Optional
translation_path (GLS only)	DLL that performs code-set conversion; default value: \$INFORMIXDIR/lib/esql/ig04a304.xx , where xx represents a platform-specific file extension	Optional
cursor_behavior_name	Flag for cursor behavior when a commit or rollback transaction is called. Possible values are: ■ 0=close cursor ■ 1=preserve cursor Default value: 0	Optional

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The following example shows the configuration for a DSN called EmpInfo:

```
[EmpInfo]
Driver=/informix/lib/cli/iclis09b.so
Description=Demo data source
Database=odbc_demo
LogonID =admin
pwd=tiger
Server=ifmx_91
CLIENT_LOCALE=en_us.8859-1
DB_LOCALE=en_us.8859-1
TRANSLATIONDLL=/opt/informix/lib/esql/igo4a304.so
VMBCHARLENEXACT=0
```

The following example shows the configuration for a DSN called Informix9:

```
[Informix9]
Driver=/work/informix/lib/cli/iclis09b.so
Description= Informix 9.x ODBC Driver
LogonID=user1
pwd=tigress4
Database=odbc_demo
ServerName=my_server
```

If you specify a null LogonID or pwd, the following error occurs:

```
Insufficient connect information supplied
```



Tip: You can establish a connection to a DSN with null values for LogonID and pwd if the local Informix database server is on the same computer where the client is located. In this case, the current user is considered a trusted user.

A sample data source, with no LogonID and pwd, where the server and client are on the same computer, might look like the following example:

```
Driver=/work/informix/lib/cli/iclis09b.so
Description=Informix 9.x ODBC Driver
LogonID=
pwd=tiger
Database=odbc_demo
ServerName=ifmx_server
```

Setting the \$ODBCINI Environment Variable

By default, Informix ODBC Driver uses configuration information found in the **\$HOME/.odbc.ini** file. If you want to provide access to your DSN by system users, modify the path in the **\$ODBCINI** environment variable to point to another configuration file that also contains the configuration information found in the **\$HOME/.odbc.ini** file. Then change the configuration file permissions to allow read access for system users. Do not change the permissions to the **\$HOME/.odbc.ini** file.

In the following example, the configuration filename is **myodbc.ini**:

```
setenv ODBCINI /work/myodbc.ini
```

The .netrc File

The **.netrc** file contains data for logging into a remote database server over the network. See the UNIX man pages for information on the **.netrc** file. Create the **.netrc** file in the home directory where the client computer initiates the connection. Set the **.netrc** file permissions for the user to deny read access by the group and others.

To connect to a remote database server, create entries in the **.netrc** file for the LogonID and pwd required to autoconnect to the data source. To establish a connection to a remote data source, the ODBC driver first reads the LogonID and pwd from the data source entry in the **\$HOME/.odbc.ini** file. If the **\$HOME/.odbc.ini** file does not specify a LogonID and pwd, the ODBC driver searches the **\$HOME/.netrc** file.

For example, to allow an autologin to the computer called **ray** using the login name **log8in** with password **mypassword**, your **.netrc** file should contain the following line:

```
machine ray login log8in password mypassword
```

Windows



Configuring a DSN on Windows

In Windows environments, Informix ODBC Driver provides a graphical user interface (GUI) to configure DSNs.

Important: To configure a DSN for *INTERSOLV DataDirect ODBC Driver, Version 3.11*, use the procedures outlined in [“Transferring INTERSOLV Values” on page 2-20](#). Then use the procedures in this section.

To configure a DSN:

- Choose a procedure to modify your DSN:
 - Choose the User DSN option to restrict access to one user.
 - Choose the System DSN option to restrict access to system users.
 - Choose the File DSN option to allow access to all users on a network.
- Enter DSN-configuration values to create a new DSN, such as the data-source name, the server name, and the database locale.



Important: You can copy most of the DSN-configuration values that you used to configure the DSN for *INFORMIX-CLI*, but you must enter new values for the DSN name and database name.

For a description of values, see [Figure 2-1 on page 2-12](#) and [Figure 2-2 on page 2-12](#). Values are shown in the order that they appear in each section.



Tip: To find out what kind of DSN you have, follow the steps in [“Reconfiguring an Existing DSN” on page 2-16](#), click the **General** tab and read the contents of the **Description** text box.

You can also use Microsoft ODBC, Version 2.5, or later, to configure a DSN.

To configure an existing DSN, see [“Reconfiguring an Existing DSN” on page 2-16](#).

Figure 2-1
Required DSN Values

Required Values	Description
Data Source Name	DSN to access This value is any name that you choose. Data Source Name is like an envelope that contains all relevant connection information about the DSN.
Database Name	Name of the database to which the DSN connects by default
Host Name	Computer on which Server resides
Protocol	Protocol used to communicate with Server Once you have added a DSN, the pull-down menu will display the available choices.
Server Name	Informix database server on which Database resides
Service	Informix database server process that runs on your Host computer Confirm the service name with your system administrator or database administrator.

Figure 2-2
Optional DSN Values

Optional Values	Description
Client Locale	Default value: en_us.1252
Database Locale	Default value: en_us.1252
Description	Any kind of information, such as version number and service
Options	General information, such as password settings For more information on this value, see the sqlhosts information in your Administrator's Guide .
Password	Password for access to the DSN

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Optional Values	Description
Translation Library	Dynamic linked library (DLL) that performs code-set conversion; default value: \$INFORMIXDIR\lib\esql\ig04n304.dll
User Id	User identification or account name for access to the DSN
Translation Option	Option for a non-Informix translation library Varying multibyte character length reporting option that specifies how to set <i>pcbValue</i> when <i>rgbValue</i> (the output area) is not large enough for the code-set-converted data Possible values: ■ 0=Estimate ■ 1=Exact Default value: 0
Cursor Behavior	Flag for cursor behavior when a commit or rollback transaction is called Possible values are: ■ 0=close cursor ■ 1=preserve cursor Default value: 0
VMB Character	Varying multibyte character length reporting option that specifies how to set <i>pcbValue</i> when <i>rgbValue</i> (the output area) is not large enough for the code-set-converted data Possible values: ■ 0=Estimate ■ 1=Exact Default value: 0

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Configuring a New User or System DSN

Use the following procedure to configure a new DSN. Choose the User DSN option in step 2 to restrict access to one user. Choose the System DSN option in step 2 to restrict access to system users.

1. Choose **Start→Settings→Control Panel**.
2. Double-click **ODBC** to open the ODBC Data Source Administrator dialog box.

To configure a user DSN, go to step 3. To configure a system DSN, click the System DSN tab and go to step 3. All subsequent steps are the same to configure either a user DSN or a system DSN.
3. Click **Add**.

The Create New Data Source dialog box appears.
4. Double-click **INFORMIX 3.30 32 BIT** on the Create New Data Source wizard.

The **General** page for the Informix ODBC Driver Setup dialog box appears.
5. Enter the values in the **General** page, as the following example shows:
 - Data Source Name: `odbc33int`
 - Description: `file DSN 3.3 on turbo`
 - Database Name: `odbc_demo`

See [“Required DSN Values” on page 2-12](#) and [“Optional DSN Values” on page 2-12](#) for a description of the values.



Important: Do not click **OK** after you enter the values on this page. If you click **OK** before you enter all the values, you will get an error message.

6. Click the **Connection** tab to display the **Connection** page and enter the values, as the following example shows:
 - Server Name: `ol_clipper`
 - Host Name: `clipper`
 - Service: `turbo`
 - Protocol: `olsoctcp`
 - Options: `csm=(SPWDCSM)`

- Database Name: `odbc_demo`
 - User Id: `myname`
 - Password: `*****`
7. Click the **Environment** tab to display the **Environment** page and enter the values, as the following example shows:
- Client Locale: `en_US.CP1252`
 - Database Locale: `en_US.CP1252`
 - Translation Library: `INFORMIXDIR\lib\esql\ig04n304.dll`
 - Translation Option: `0`
 - Cursor Behavior: `0 - Close`
 - VMB Character: `0 - Estimate`
8. Click the **Advanced** tab to display the **Advanced** page and click all applicable boxes.
- **Enable Scrollable Cursor**

If this option is activated, Informix ODBC 3.3 driver supports only scrollable, static cursors. This option is available only as a connection option:

`SQL_INFX_ATTR_ENABLE_SCROLL_CURSORS`

The default is: `0` (disabled).
 - **Enable Insert Cursor**

This option will reduce the number of network messages sent to and from the server by buffering the inserted rows that are used with arrays of parameters and insert statements. This option can greatly improve the performance of bulk insert operations, and is available as both connection and statement options:

`SQL_INFX_ATTR_ENABLE_INSERT_CURSORS`

The default is: `0` (disabled).
 - **Enable auto commit optimization**

This option defers automatic commit operations while cursors remain open and can reduce database communication when the application is using non-ANSI logging databases. This option is available only as a connection option:

`SQL_INFX_ATTR_OPTIMIZE_AUTOCOMMIT`

The default is: `1` (enabled).

9. To check your connection to the database server, click **Test Connection**.
10. Click **OK** to return to the ODBC Data Source Administrator dialog box and to update the DSN information in the appropriate files.
When your application connects to this DSN, the values that you entered are the default entries for the DSN connection.

Removing a DSN

Use the following procedure to remove a DSN:

1. Follow steps 1 and 2 in [“Configuring a New User or System DSN” on page 2-14](#).
2. Click **Remove** in the ODBC Data Source Administrator dialog box.
The 32-bit ODBC Administrator dialog box appears.
3. Click **Yes** to remove the DSN and return to the ODBC Data Source Administrator dialog box.

Reconfiguring an Existing DSN

Use the following procedure to reconfigure an existing DSN:

1. Follow steps 1 and 2 in [“Configuring a New User or System DSN” on page 2-14](#).
2. Click **Configure** to display the Informix ODBC Driver Setup dialog box.
Enter the new configuration values in the corresponding text boxes and click **OK** to return to the ODBC Data Source Administrator dialog box.

After you complete these steps, you will be able to connect to the DSN.

Configuring a File DSN

Choose the File DSN option to allow access to the DSN to all users on a network. See [Figure 2-1](#) and [Figure 2-2 on page 2-12](#) for a description of values.

Use the following procedure to configure a file DSN:

1. Choose **Start→Settings→Control Panel**.
2. Double-click the ODBC icon to open the ODBC Data Source Administrator dialog box.
3. Click the **File DSN** tab to display the **File DSN** page.
4. Click **Add**.
The Create New Data Source wizard appears.
5. Select **INFORMIX 3.30 32 BIT** from the driver list and click **Next** to display the Create New Data Source Setup wizard, which contains a file data source text box.
6. If you know the name of the data source file, type the name into the text box, click **Next** to display the completed Create New Data Source wizard, and go to Step 9.

If you do not know the name of the file, click **Browse** to display the Save As dialog box and enter the values, as the following example shows:

- File Name: File_DSN
- Save as type: ODBC File Data Sources

Select a filename or type a filename in the **File_name** text box.

7. Click **Save** to display the Create New Data Source wizard, which displays information about the data source name.
8. Click **Next** to display the completed Create New Data Source wizard.
9. Click **Finish** to display the Informix Connect dialog box. For a description of the values, see [Figure 2-1](#) and [Figure 2-2 on page 2-12](#).

10. Enter the values, as the following example shows:

- Database: `odbc_demo`
- Server: `ol_clipper`
- Host: `clipper`
- Service: `turbo`
- Protocol: `olsoctcp`
- UID: `myname`
- PWD: `*****`

11. Click **OK** to save the values and display the ODBC Data Source Administrator dialog box.

The name of the data file that you chose or typed in step 6 appears in the text box.

After you add or change DSN-configuration information, the driver updates the appropriate Windows registry to reflect the specified values. To be compatible with other Informix connectivity products, the driver stores the DSN-configuration information in the Windows registry.

Activating the Tracing Options

To create logs of calls to the drivers, use the following procedure to activate the tracing options:

1. Click the **Tracing** tab to display the **Tracing** page, as [Figure 2-3](#) shows.

Figure 2-3
Tracing Page

2. Select the frequency of tracing from the **When to trace** group.
Don't trace is the default setting.
3. To enter an existing log file, click **Browse** to display the Select ODBC Trace File dialog box.
4. Enter the filename in the **File_name** text box and click **Save** to return to the **Tracing** page.
5. To select a custom trace dynamic link library (DLL), click **Select DLL** to display the Select a custom trace dll dialog box, and enter the values, as the following example shows:

- File name: test2_dsn
- Files of type: Dynamic link libraries (*.dll)

Choose a file or type a filename in the **File_name** text box.

6. Click **Open** to display the Tracing page.
7. Click **OK** to save the changes.

After you complete these steps, you will connect to the DSN.

Transferring INTERSOLV Values

To configure a DSN on a computer that already has INTERSOLV DataDirect ODBC Driver installed, use the procedures in this section to access the INTERSOLV DataDirect ODBC Driver values.



Important: See the *DSNMigrate readme* file before transferring INTERSOLV values.

Make a note of the values and then follow the procedures outlined in [“Configuring a New User or System DSN” on page 2-14](#) or [“Configuring a File DSN” on page 2-17](#). See the description of values in [Figure 2-4](#) and [Figure 2-5 on page 2-21](#).

To display previous INTERSOLV DataDirect ODBC Driver values:

1. Choose **Start→Settings→Control Panel**.
2. Double-click the ODBC icon to open the ODBC Data Source Administrator dialog box.
3. Select **INTERSQLV 3.11 32 BIT** and click **Configure** to display the INFORMIX ODBC Driver Setup dialog box.
4. Click each tab to access the INTERSOLV values.
5. After you make a note of the values, click **Cancel** to return to the ODBC Data Source Administrator dialog box.
6. Follow the steps in [“Configuring a New User or System DSN” on page 14](#) to add the INTERSOLV values to the Informix ODBC Driver Setup dialog box.

When your application connects to this DSN, the values that you enter are the default entries for the DSN connection.

After you complete these steps, you will connect to the DSN.

Figure 2-4
Required Data Source Value

Required Values in Informix ODBC Driver Setup Dialog Box	Description of Values	Location of Corresponding INTERSOLV Values in the ODBC INFORMIX Driver Setup Dialog Box
Data Source Name	Any name	General tab Data Source Name text box
Description	Any information, such as version number and service	General tab Description text box
Database Name	Default database name	General tab Database Name text box
Server	Server on which database resides	Connection tab Server Name text box
Host	Computer on which server resides	Connection tab Host Name text box
Service	Informix database server process that runs on your host computer Confirm name with your system administrator or database administrator	Connection tab Service Name text box

Figure 2-5
Optional Data Source Values

Optional Values in Informix ODBC Driver Setup Dialog Box	Description of Values	Location of Corresponding INTERSOLV Values in the ODBC INFORMIX Driver Setup Dialog Box
User Id	User identification or account name	Connection page Default User Name text box
Password	Access password	The administrator's password
Options	Any information, such as password settings	none
Client Locale	Client locale Default value: en_us.1252	none

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Optional Values in Informix ODBC Driver Setup Dialog Box	Description of Values	Location of Corresponding INTERSOLV Values in the ODBC INFORMIX Driver Setup Dialog Box
Database Locale	Database locale Default value: en_us.1252	none
Translation Library	Dynamically linked library (DLL) that performs code-set conversion Default value: \$INFORMIXDIR \lib\esql\ig04n304.dll	none
Translation Option	Option for a non-Informix translation library Varying multibyte character length reporting option that specifies how to set <i>pcbValue</i> when <i>rgbValue</i> (the output area) is not large enough for the code-set-converted data Possible values: ■ 0=Estimate ■ 1=Exact Default value: 0	none
Cursor Behavior	Flag for cursor behavior when a commit or rollback transaction is called Possible values: ■ 0=close cursor (default) ■ 1=preserve cursor	Advanced page Cursor Behavior text box
VMB Character	Varying multibyte character length reporting option that specifies how to set <i>pcbValue</i> when <i>rgbValue</i> (the output area) is not large enough for the code-set-converted data Possible values: ■ 0=Estimate ■ 1=Exact Default value: 0	none

Migrating to Informix ODBC Driver

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In This Chapter

This chapter explains how to migrate from INFORMIX-CLI, Version 2.8, or INTERSOLV DataDirect ODBC Driver, Version 3.11, to Informix ODBC Driver, Version 3.3, on UNIX and Windows. Follow the procedures outlined in [Chapter 2](#) to modify your data-source (DSN) configuration before you use the procedures in this chapter to migrate.

Migrating a DSN Connection on UNIX

To migrate to Informix ODBC Driver from INFORMIX-CLI, Version 2.8, if you have a DSN connection on UNIX, you must modify your DSN configuration.

Important: *You do not need to modify your DSN if you are using the INTERSOLV DataDirect ODBC Driver.*

To modify your DSN if you are using INFORMIX-CLI, choose one of the following procedures:

- [“Modifying a DSN on UNIX” on page 3-4](#) to restrict access to one user.
- [“Modifying a File DSN on UNIX” on page 3-6](#) to allow access to all users on a network.

After you choose the access level, you can use the same procedure to migrate from INFORMIX-CLI.

To find out what DSN configuration is on your computer, find the configuration description under the name of your DSN in the ODBC Data Sources section of the **.odbc.ini** file.



Important: When you type strings into the text boxes, be sure to type them exactly as the procedures specify. If you do not type them exactly, you might get an incomplete connection and will have to redo the procedures. If you are viewing this document online, copy and paste the values from the document instead of typing them in.

Modifying a DSN on UNIX

Use [Figure 3-1](#) and the corresponding procedure to modify a DSN. This procedure restricts access to one user.

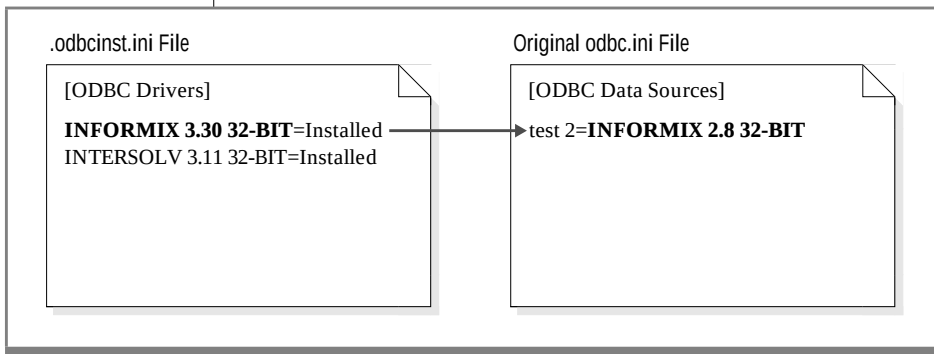


Figure 3-1
DSN Values

To change the DSN value

1. Open the **\$HOME/.odbcinst.ini** and the **\$HOME/.odbc.ini** files in a text editor.
2. Find the Informix 3.3 DSN value in the **ODBC Drivers** section of the **\$HOME/.odbcinst.ini** file.

In [Figure 3-1](#), the DSN value is in bold letters.

3. In the **\$HOME/.odbc.ini** file, find the DSN name and value for the DSN that you are migrating in the **ODBC Data Sources** section.

In [Figure 3-1](#), the name of the DSN is test 2 and the DSN value is in bold letters.

4. Replace the DSN value for test 2 in the **\$HOME/.odbc.ini** file with the DSN value from the **\$HOME/.odbcinst.ini** file, as [Figure 3-2](#) shows:

Original DSN value (in this case corresponding to CLI 2.8):

```
test2=INFORMIX 2.8 32-BIT
```

New DSN value:

```
test2=INFORMIX 3.30 32-BIT
```

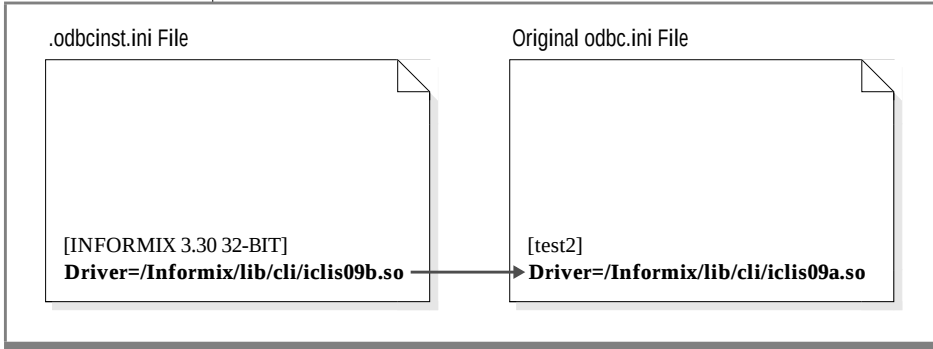


Figure 3-2
Driver-Name
Values

To change the driver-name value

1. In the **\$HOME/.odbcinst.ini** file, find the driver-name value in the **Informix 3.30 32-BIT** section.
In [Figure 3-2](#), the driver-name value is in bold letters.
2. In the **\$HOME/.odbc.ini** file, find the driver name and value for the driver that you are migrating.

In [Figure 3-2](#), the name of the driver is test 2 and its value is in bold letters.

3. Replace the driver-name value in the **\$HOME/.odbc.ini** file with the driver-name value in the **\$HOME/.odbcinst.ini** file, as the following example shows:

Original driver-name value (in this case corresponding to CLI 2.8):

```
Driver =/Informix/lib/cli/icli09a.so
```

New driver-name value:

```
Driver =/Informix/lib/cli/icli09b.so
```

4. Save the changes to the **\$HOME/.odbc.ini** file.

Figure 3-3 shows the modified **\$HOME/.odbc.ini** file. The new DSN name values and driver-name values are in bold letters.

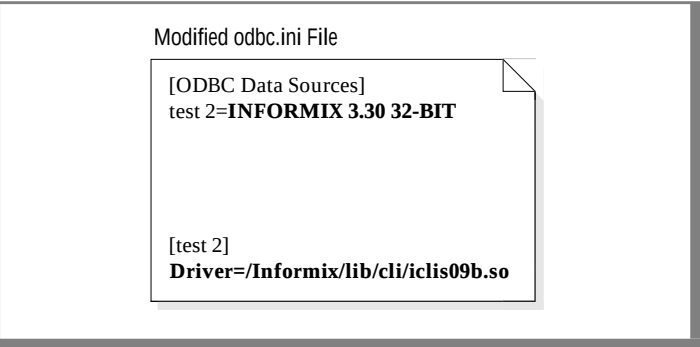


Figure 3-3
Modified
odbc.ini File



Tip: To allow access of the DSN by system users, see [“Setting the \\$ODBCINI Environment Variable” on page 2-10.](#)

Modifying a File DSN on UNIX

If you have a file DSN, open the file DSN in a text editor and use [Figure 3-4](#) as a guide to substitute the new Informix ODBC Driver values for INFORMIX-CLI values.



Important: You must change the settings in the **.netrc** file if you want to restrict access to a trusted host. For more information, see [“The .netrc File” on page 2-10.](#)

Figure 3-4
Informix ODBC 3.3 Values for File DSN on UNIX

Keyword	New Informix ODBC 3.3 Value to Substitute	Value Requirement
DRIVER	INFORMIX 3.30 32-BIT	required
UID	odbc	optional
DATABASE	odbctestdsn	required
HOST	tempest	optional
PASSWORD	*****	optional

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Keyword	New Informix ODBC 3.3 Value to Substitute	Value Requirement
SERVER	ol_tempest	required
SERVICE	turbo	optional
PROTOCOL	olsoctcp	optional
CLIENT_LOCALE	en_US.CP1252	optional
DB_LOCALE	en_US.CP1252	optional
TRANSLATIONDLL	turbo	optional
TRANSLATIONOPTION	0	optional
VMCHARLENEXACT	0	optional
CONNECTDATABASE	0	optional
EXCLUSIVE	0	optional
CURSORBEHAVIOR	0	optional

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Windows

Migrating a DSN Connection on Windows

To migrate to Informix ODBC Driver from INFORMIX-CLI or INTERSOLV DataDirect ODBC Driver if you use a DSN connection on Windows, perform the following steps:

1. Make a backup of the registry files.
2. Modify your DSN. Choose one of the following procedures:
 - User DSN (to restrict access to one user)
 - System DSN (to restrict access to system users)
 - File DSN (to allow access to all users on a network)

Important: See the **DSNMigrate readme** file before using these procedures.



Backing Up and Restoring the Registry Files

Back up the registry files before you begin the migration procedure and back up the files frequently during the procedure. Use a different filename for each back up.

To back up your registry files

1. Choose **Start→Run** to display the Run dialog box.
2. Type `Regedit` in the **Open** text box and click **OK** to display the Registry Editor dialog box.
3. Click **HKEY_LOCAL_MACHINE\SOFTWARE\ODBC** to backup files configured for a system DSN, or **HKEY_CURRENT_USER\SOFTWARE\ODBC** to backup files configured for a user DSN.
4. Choose **Registry→Export Registry File** to display the Export Registry File dialog box.
5. Check **Selected branch** in the **Export range** section at the bottom left of the page.
6. Enter a backup filename in the **File name** text box.
7. Click **Save**.



Tip: To back up files configured for a file DSN, you only need to make a backup copy of the file.

To restore the registry files

1. Choose **Registry→Import Registry File** to display the Import Registry File dialog box.
2. Double-click the backup file to restore it.

Modifying Your DSN on Windows

To modify your DSN on Windows, choose either user, system, or file DSN modification. To find out what kind of DSN you have, follow the steps in [“Reconfiguring an Existing DSN” on page 2-16](#), click the **General** tab and read the contents of the **Description** text box.



After you choose the type of modification, you can use the same procedure to migrate from INFORMIX-CLI or INTERSOLV DataDirect ODBC Driver.

Important: When you type strings into the text boxes, be sure to type them exactly as the procedures specify. In particular, be careful not to add extra spaces at the beginning or end of strings. If you do not type the strings exactly, you might get an incomplete connection and will have to redo the procedures. If you are viewing this document online, copy and paste the values from the document instead of typing them in.

If you are migrating several DSNs at one time, you can paste the DSN value and the driver value into a text file, and copy the values from this file to the corresponding text boxes.

Modifying a User or System DSN

A user DSN restricts access to one user. A system DSN restricts access to system users. To modify a user or system DSN, you must first modify the DSN value and then modify the driver-string value.

To modify the DSN value

1. Choose **Start→Run** to display the Run dialog box.
2. Type `Regedit` in the **Open** text box and click **OK** to display the Registry Editor dialog box.
3. Click **HKEY_CURRENT_USER** if you are modifying a user DSN, or **HKEY_LOCAL_MACHINE** if you are modifying a system DSN.
All subsequent steps are the same to modify a user DSN or a system DSN.
4. Click **SOFTWARE\ODBC\ODBC.INI\ODBC Data Sources**.
5. Double-click the name of the DSN (either `cli2.8` or `INTERSOLV`) in the right side of the Registry Editor dialog box to display the **Edit String** text box.
6. Replace the contents of the **Value data** text box with the following string: `INFORMIX 3.30 32-BIT`
7. Click **OK** to save the new DSN value.

To modify the driver-string value

1. Click **HKEY_LOCAL_MACHINE \ SOFTWARE \ ODBC \ ODBCINST.INI \ INFORMIX 3.30 32-BIT**.
2. Double-click the driver-string value in the right side of the Registry Editor dialog box to display the Edit String dialog box.

The following example shows the driver-string value in bold letters:

Driver "C:\Informix\bin\iclit09b.dll"

3. Copy the contents of the **Value data** text box to the clipboard.
4. Click **Cancel**.
5. If you are modifying a user DSN, click **HKEY_CURRENT_USER \ SOFTWARE \ ODBC \ ODBC.INI**.
If you are modifying a system DSN, click **HKEY_LOCAL_MACHINE \ SOFTWARE \ ODBC \ ODBC.INI**.
6. In the ODBC.INI folder, double-click the folder corresponding to the DSN that you are migrating to Informix ODBC Driver (for example, **cli28int** or **INTERSOLV**).

Use the same DSN that you modified in ["To modify the DSN value" on page 3-9](#).

7. Double-click the driver-string value in the right side of the Registry Editor dialog box to display the Edit String dialog box. The following example shows a driver-string value in bold letters:

Driver "C:\Informix\bin\iclit09a.dll"

8. Replace the contents of the **Value data** text box with the contents of the clipboard that you copied in step 3. In the example, the contents of the String Editor dialog box would be changed as follows:

Original contents:

Driver "C:\Informix\bin\iclit09a.dll"

New contents:

Driver "C:\Informix\bin\iclit09b.dll"

9. Click **OK** to save the new driver value.

Modifying a File DSN on Windows

You must have write privileges to the File DSN to modify it.

To modify a file DSN

1. Make a backup copy of the File DSN. You can place your file DSN at any location on your computer, but the conventional location is:

`C:\Program Files\Common Files\Odbc\Data Sources\ File DSN`

2. Open the File DSN in a text editor.
3. Replace the driver-name value (in the string that begins with Driver =) with INFORMIX 3.30 32-BIT.
4. Save your changes.

Migrating a DSN-Less Connection on UNIX and Windows

To migrate a DSN-less connection, connect to the database server and change the driver-name value in the source file.

Connect to the database server with your present driver if you are migrating from:

1. INFORMIX-CLI, Version 2.8, on Windows or UNIX
2. INTERSOLV DataDirect ODBC Driver, Version 3.11, on Windows

Connect to the database server with Informix ODBC Driver, Version 3.3, if you are migrating from INTERSOLV DataDirect ODBC Driver, Version 3.11, on UNIX. After you connect to the database server, follow the procedure in [“To migrate a DSN-less connection” on page 3-11](#).

Important: When you type strings into the text boxes, be sure to type them exactly as the procedures specify. If you do not type them exactly, you might get an incomplete connection and will have to redo the procedures. If you are viewing this document online, copy and paste the values from the document instead of typing them in.

If you are migrating several DSNs at one time, you can paste the DSN value and the driver value into a text file and copy the values from this file to the corresponding text boxes.

UNIX



To migrate a DSN-less connection

1. Open your application.
2. In the source file, find the string that contains the SQLDriverConnect information, which includes the driver name.

In the following example, the string for the INFORMIX-CLI, Version 2.8, driver name is in bold letters:

```
rc=SQLDriverConnect
(hdbc, NULL, "DRIVER = {INFORMIX 2.8 32-BIT}; DATABASE=ovs;
HOST=clipper;SERVICE=turbo;SERVER=ol_clipper;
PROTOCOL=onsoctcp;UID=odbc;PWD=odbc", SQL_NTS, szerrormessage,
256, pcberrormessage, SQL_DRIVER_NOPROMPT)
```

3. Change the driver name to INFORMIX 3.30 32-BIT.

If you are using English with Informix ODBC Driver, you do not have to change the default values for the CLIENT_LOCALE and the DB_LOCALE. If you are using another language, you must enter the correct values for that language. For instructions on how to specify a nondefault locale, additional syntax, and other considerations related to GLS locales, see the [Informix Guide to GLS Functionality](#). ♦

Data Types

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In This Chapter

This chapter discusses the following topics:

- Kinds of data types
- SQL data types
- C data types
- Transferring data
- Converting data

Data Types

The following table describes the data types that Informix ODBC Driver supports.

Data Type	Description	Example
Informix SQL data type	Data types that your Informix database server uses	CHAR(<i>n</i>)
Informix ODBC Driver SQL data type	Data types that correspond to the Informix SQL data types	SQL_CHAR
Standard C data type	Data types that your C compiler defines	unsigned char
Informix ODBC Driver typedef	Typedefs that correspond to the standard C data types	UCHAR
Informix ODBC Driver C data type	Data types that correspond to the standard C data types	SQL_C_CHAR

SQL Data Types

For detailed information about the Informix SQL data types, see the [Informix Guide to SQL: Reference](#), the [Informix Guide to SQL: Tutorial](#), and *Extending Informix Dynamic Server*.

Standard SQL Data Types

The following table lists the standard Informix SQL data types and their corresponding Informix ODBC Driver data types.

Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
BOOLEAN (IDS & IDS/UD)	SQL_BIT	't' or 'f'
BYTE	SQL_LONGVARIABLE	Binary data of variable length
CHAR(<i>n</i>), CHARACTER(<i>n</i>)	SQL_CHAR	Character string of fixed length <i>n</i> (1 ≤ <i>n</i> ≤ 32,767)
CHARACTER VARYING(<i>m</i> , <i>r</i>)	SQL_VARCHAR	Character string of variable length with maximum length <i>m</i> (1 ≤ <i>m</i> ≤ 255) and minimum amount of reserved space <i>r</i> (0 ≤ <i>r</i> < <i>m</i>)
DATE	SQL_DATE	Calendar date
DATETIME	SQL_TIMESTAMP	Calendar date and time of day
DEC(<i>p</i> , <i>s</i>), DECIMAL(<i>p</i> , <i>s</i>)	SQL_DECIMAL	Signed numeric value with precision <i>p</i> and scale <i>s</i> (1 ≤ <i>p</i> ≤ 32; 0 ≤ <i>s</i> ≤ <i>p</i>)
DOUBLE PRECISION	SQL_DOUBLE	Signed numeric value with the same characteristics as the standard C double data type
FLOAT	SQL_DOUBLE	Signed numeric value with the same characteristics as the standard C double data type

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Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
INT, INTEGER	SQL_INTEGER	Signed numeric value with precision 10, scale 0, and range n $(-2,147,483,647 \leq n \leq 2,147,483,647)$
INT8 (IDS & IDS / UD)	SQL_BIGINT	Signed numeric value with precision 10, scale 0, and range n $(-(2^{63} - 1) \leq n \leq 2^{63} - 1)$
INTERVAL MONTH(p)	SQL_INTERVAL_MONTH	Number of months between two dates; p is the interval leading precision.
INTERVAL YEAR(p)	SQL_INTERVAL_YEAR	Number of years and months between two dates; p is the interval leading precision.
INTERVAL YEAR(p) TO MONTH	SQL_INTERVAL_YEAR_TO_MONTH	Number of years and months between two dates; p is the interval leading precision.
INTERVAL DAY(p)	SQL_INTERVAL_DAY	Number of days between two dates; p is the interval leading precision.
INTERVAL HOUR(p)	SQL_INTERVAL_HOUR	Number of hours between two date times; p is the interval leading precision.
INTERVAL MINUTE(p)	SQL_INTERVAL_MINUTE	Number of minutes between two date / times; p is the interval leading precision.
INTERVAL SECOND(p,q)	SQL_INTERVAL_SECOND	Number of seconds between two date / times; p is the interval leading precision and q is the interval seconds precision.
INTERVAL DAY(p) TO HOUR	SQL_INTERVAL_DAY_TO_HOUR	Number of days / hours between two date / times; p is the interval leading precision.
INTERVAL DAY(p) TO MINUTE	SQL_INTERVAL_DAY_TO_MINUTE	Number of days / hours / minutes between two date / times; p is the interval leading precision.

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Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
INTERVAL DAY(<i>p</i>) TO SECOND(<i>q</i>)	SQL_INTERVAL_DAY_TO_SECOND	Number of days / hours / minutes / seconds between two date / times; <i>p</i> is the interval leading precision and <i>q</i> is the interval seconds precision.
INTERVAL HOUR TO MINUTE	SQL_INTERVAL_HOUR_TO_MINUTE	Number of hours / minutes between two date / times; <i>p</i> is the interval leading precision.
INTERVAL HOUR(<i>p</i>) TO SECOND(<i>q</i>)	SQL_INTERVAL_HOUR_TO_SECOND	Number of hours / minutes / seconds between two date / times; <i>p</i> is the interval leading precision and <i>q</i> is the interval seconds precision.
INTERVAL MINUTE(<i>p</i>) TO SECOND(<i>q</i>)	SQL_INTERVAL_MINUTE_TO_SECOND	Number of minutes / seconds between two date / times; <i>p</i> is the interval leading precision and <i>q</i> is the interval seconds precision.
LVARCHAR (IDS & IDS / UD)	SQL_LONGVARCHAR	Character string of variable length
MONEY(<i>p</i> , <i>s</i>)	SQL_DECIMAL	Signed numeric value with precision <i>p</i> and scale <i>s</i> ($1 \leq p \leq 32$; $0 \leq s \leq p$)
NUMERIC	SQL_NUMERIC	Signed, exact, numeric value with precision <i>p</i> and scale <i>s</i> ($1 \leq p \leq 15$; $0 \leq s \leq p$)
REAL	SQL_REAL	Signed numeric value with the same characteristics as the standard C float data type
SERIAL	SQL_INTEGER	Sequential INTEGER
SERIAL8 (IDS & IDS / UD)	SQL_BIGINT	Sequential INT8
SMALLFLOAT	SQL_REAL	Signed numeric value with the same characteristics as the standard C float data type

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Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
SMALLINT	SQL_SMALLINT	Signed numeric value with precision 5, scale 0, and range n ($-32,767 \leq n \leq 32,767$)
TEXT	SQL_LONGVARCHAR	Character string of variable length
VARCHAR(m, r)	SQL_VARCHAR	Character string of variable length with maximum length m ($1 \leq m \leq 255$) and minimum amount of reserved space r ($0 \leq r < m$)

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GLS

Additional SQL Data Types for GLS

The following table lists the additional Informix SQL data types for GLS and their corresponding Informix ODBC Driver data types. Informix ODBC Driver does not provide full GLS support. For more information about GLS, see the [Informix Guide to GLS Functionality](#).

Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
NCHAR(n)	SQL_CHAR	Character string of fixed length n ($1 \leq n \leq 32,767$). Collation depends on locale.
NVARCHAR(m, r)	SQL_VARCHAR	Character string of variable length with maximum length m ($1 \leq m \leq 255$) and minimum amount of reserved space r ($0 \leq r < m$). Collation depends on locale.

Additional SQL Data Types for Dynamic Server with UD Option

The following table lists the additional Informix SQL data types for Dynamic Server with UD Option and their corresponding Informix ODBC Driver data types. To use the Informix ODBC Driver SQL data types for Dynamic Server with UD Option, include **infxccli.h**.

Informix SQL Data Type	Informix ODBC Driver SQL Data Type (fSqlType)	Description
Collection (LIST, MULTiset, SET)	Any Informix ODBC Driver SQL data type	Composite value that consists of one or more elements, where each element has the same data type.
DISTINCT	Any Informix ODBC Driver SQL data type	UDT that is stored the same way as its source data type but has different casts and functions
OPAQUE (fixed)	SQL_INFX_UDT_FIXED	Fixed-length UDT with an internal structure that has the same size for all possible values
OPAQUE (varying)	SQL_INFX_UDT_VARYING	Variable-length UDT with an internal structure that can have a different size for each different value
Row (Named row, unnamed row)	Any Informix ODBC Driver SQL data type	Composite value that consists of one or more elements, where each element can have a different data type. For more information, see Chapter 6 .
Smart large object (BLOB or CLOB)	SQL_IFMX_UDT_BLOB SQL_IFMX_UDT_CLOB	Large object that is stored in an sbspace on disk and is recoverable. For more information, see Chapter 5 .

Precision, Scale, Length, and Display Size

The functions that get and set precision, scale, length, and display size for SQL values have size limitations for their input arguments. Therefore, these values are limited to the size of an SDWORD that has a maximum value of 2,147,483,647. The following table describes these values.

Value	Description for a Numeric Data Type	Description for a Non-Numeric Data Type
Precision	Maximum number of digits.	Either the maximum length or the specified length.
Scale	Maximum number of digits to the right of the decimal point. For floating point values, the scale is undefined because the number of digits to the right of the decimal point is not fixed.	Not applicable.
Length	Maximum number of bytes that a function returns when a value is transferred to its default C data type.	Maximum number of bytes that a function returns when a value is transferred to its default C data type. The length does not include the NULL termination byte.
Display size	Maximum number of bytes needed to display data in character form.	Maximum number of bytes needed to display data in character form.

Standard SQL Data Types

The following table describes the precision, scale, length, and display size for the standard Informix ODBC Driver SQL data types.

Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_BIGINT (IDS & IDS / UD)	Precision: 19. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: 0. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 8 bytes. Display size: 20 digits. One digit is for the sign.
SQL_BIT (IDS & IDS / UD)	Precision: 1. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: 0. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 1 byte. Display size: 1 digit.
SQL_CHAR	Precision: Same as the length. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: The specified length. For example, the length of CHAR(10) is 10 bytes. Display size: Same as the length.
SQL_DATE	Precision: 10. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 6 bytes. Display size: 10 digits in the format yyyy-mm-dd.

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Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_DECIMAL	Precision: The specified precision. For example, the precision of DECIMAL (12, 3) is 12. Scale: The specified scale. For example, the scale of DECIMAL(12, 3) is 3. Length: The specified precision plus 2. For example, the length of DECIMAL(12, 3) is 14 bytes. The two additional bytes are used for the sign and the decimal points because functions return this data type as a character string. Display size: Same as the length.
SQL_DOUBLE	Precision: 15. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 8 bytes. Display size: 22 digits. The digits are for a sign, 15 numeric characters, a decimal point, the letter E, another sign, and 2 more numeric characters.
SQL_INTEGER	Precision: 10. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: 0. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 4 bytes. Display size: 11 digits. One digit is for the sign.
SQL_LONGVARBINARY	Precision: Same as the length. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: The maximum length. If a function cannot determine the maximum length, it returns SQL_NO_TOTAL. Display size: The maximum length times 2. If a function cannot determine the maximum length, it returns SQL_NO_TOTAL.

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Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_LONGVARCHAR	Precision: Same as the length. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: The maximum length. If a function cannot determine the maximum length, it returns SQL_NO_TOTAL. Display size: Same as the length.
SQL_REAL	Precision: 7. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 4 bytes. Display size: 13 digits. The digits are for a sign, 7 numeric characters, a decimal point, the letter E, another sign, and 2 more numeric characters.
SQL_SMALLINT	Precision: 5. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: 0. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: 2 bytes. Display size: 6 digits. One digit is for the sign.
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Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_TIMESTAMP	Precision: 8. SQLBindParameter ignores the value of <i>cbColDef</i> for this data type. Scale: The number of digits in the FRACTION field. Length: 16 bytes. Display size: 19 or more digits: ■ If the scale of the time stamp is 0: 19 digits in the format yyyy-mm-dd hh:mm:ss. ■ If the scale of the time stamp exceeds 0: 20 digits plus digits for the FRACTION field in the format yyyy-mm-dd hh:mm:ss.f...
SQL_VARCHAR	Precision: Same as the length. Scale: Not applicable. SQLBindParameter ignores the value of <i>ibScale</i> for this data type. Length: The specified length. For example, the length of VARCHAR(10) is 10 bytes. Display size: Same as the length.

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Additional SQL Data Types for Dynamic Server with UD Option

The following table describes the precision, scale, length, and display size for the Informix ODBC Driver SQL data types for Dynamic Server with UD Option.

Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_IFMX_UDT_BLOB	Precision: Variable value. To determine this value, call a function that returns the precision for a column. Scale: Not applicable. A function that returns the scale for a column returns -1 for this data type. Length: Variable value. To determine this value, call a function that returns the length for a column. Display Size: Variable value. To determine this value, call a function that returns the display size for a column.
SQL_IFMX_UDT_CLOB	Precision: Variable value. To determine this value, call a function that returns the precision for a column. Scale: Not applicable. A function that returns the scale for a column returns -1 for this data type. Length: Variable value. To determine this value, call a function that returns the length for a column. Display Size: Variable value. To determine this value, call a function that returns the display size for a column.

Informix ODBC Driver SQL Data Type (fSqlType)	Description
SQL_INFX_UDT_FIXED	Precision: Variable value. To determine this value, call a function that returns the precision for a column. Scale: Not applicable. A function that returns the scale for a column returns -1 for this data type. Length: Variable value. To determine this value, call a function that returns the length for a column. Display Size: Variable value. To determine this value, call a function that returns the display size for a column.
SQL_INFX_UDT_VARYING	Precision: Variable value. To determine this value, call a function that returns the precision for a column. Scale: Not applicable. A function that returns the scale for a column returns -1 for this data type. Length: Variable value. To determine this value, call a function that returns the length for a column. Display Size: Variable value. To determine this value, call a function that returns the display size for a column.

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C Data Types

An Informix ODBC Driver application uses C data types to store values that the application processes. The following table describes the C data types that Informix ODBC Driver provides.

Important: String arguments in Informix ODBC Driver functions are unsigned. Therefore, you need to cast a CString object as an unsigned string before you use it as an argument in an Informix ODBC Driver function.

Kind of Value	Informix ODBC Driver C Data Type (fCType)	Informix ODBC Driver Typedef	Standard C Data Type
Binary	SQL_C_BINARY	UCHAR FAR *	unsigned char FAR *
Boolean (IDS & IDS/UD)	SQL_C_BIT	UCHAR	unsigned char
Character	SQL_C_CHAR	UCHAR FAR *	unsigned char FAR *
Date	SQL_C_DATE	DATE_STRUCT	struct tagDATE_STRUCT { SWORD year; UWORD month; UWORD day; }
Interval	SQL_C_INTERVAL_YEAR	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_MONTH	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_DAY	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_HOUR	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_MINUTE	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_SECOND	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_YEAR_TO_MONTH	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_DAY_TO_HOUR	SQL_INTERVAL_STRUCT	C Interval Structure

Kind of Value	Informix ODBC Driver C Data Type (fCType)	Informix ODBC Driver Typedef	Standard C Data Type
Numeric	SQL_C_INTERVAL_DAY_TO_MINUTE	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_DAY_TO_SECOND	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_HOUR_TO_MINUTE	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_HOUR_TO_SECOND	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_INTERVAL_MINUTE_TO_SECOND	SQL_INTERVAL_STRUCT	C Interval Structure
	SQL_C_DOUBLE	SDOUBLE	signed double
	SQL_C_FLOAT	SFLOAT	signed float
	SQL_C_LONG	SDWORD	signed long int
	SQL_C_NUMERIC	SQL_NUMERIC_STRUCT	<pre>struct tag SQL_NUMERIC_STRUCT { SQLCHAR precision; SQLCHAR scale; SQLCHAR sign; SQLCHAR val [SQL_MAX_ NUMERIC_LEN]; }SQL_NUMERIC_STRUCT;</pre>
	SQL_C_SHORT	SWORD	signed short int
	SQL_C_SLONG	SDWORD	signed long int
	SQL_C_SSHORT	SWORD	signed short int
	SQL_C_STINYINT	SCHAR	signed char
	SQL_C_TINYINT	SCHAR	signed char
	SQL_C_ULONG	UDWORD	unsigned long int

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Kind of Value	Informix ODBC Driver C Data Type (fCType)	Informix ODBC Driver Typedef	Standard C Data Type
Time stamp	SQL_C_USHORT	UWORD	unsigned short int
	SQL_C_UTINYINT	UCHAR	unsigned char
	SQL_C_TIMESTAMP	TIMESTAMP_STRUCT	struct tagTIMESTAMP_STRUCT { SWORD year; UWORD month; UWORD day; UWORD hour; UWORD minute; UWORD second; UDWORD fraction; }

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C Interval Structure

The following structures specify the C data type for the SQL interval data type:

```
typedef struct tagSQL_INTERVAL_STRUCT
{
    SQLINTERVAL interval_type;
    SQLSMALLINT interval_sign;
    union
    {
        SQL_YEAR_MONTH_STRUCT year_month;
        SQL_DAY_SECOND_STRUCT day_second;
    } intval;
} SQLINTERVAL_STRUCT;

typedef enum
{
    SQL_IS_YEAR=1,
    SQL_IS_MONTH=2,
    SQL_IS_DAY=3,
    SQL_IS_HOUR=4,
    SQL_IS_MINUTE=5,
    SQL_IS_SECOND=6,
    SQL_IS_YEAR_TO_MONTH=7,
    SQL_IS_DAY_TO_HOUR=8,
    SQL_IS_DAY_TO_MINUTE=9,
    SQL_IS_DAY_TO_SECOND=10,
    SQL_IS_HOUR_TO_MINUTE=11,
    SQL_IS_HOUR_TO_SECOND=12,
    SQL_IS_MINUTE_TO_SECOND=13,
} SQLINTERVAL;

typedef struct tagSQL_YEAR_MONTH
{
    SQLINTEGER year;
    SQLINTEGER month;
} SQL_YEAR_MONTH_STRUCT;

typedef struct tagSQL_DAY_SECOND
{
    SQLINTEGER day;
    SQLINTEGER hour;
    SQLINTEGER minute;
    SQLINTEGER second;
    SQLINTEGER fraction;
} SQL_DAY_SECOND_STRUCT;
```

Transferring Data

Among data sources that use the same DBMS, you can safely transfer data in the internal form that a DBMS uses. For a particular piece of data, the SQL data types must be the same in the source and target data sources. The C data type is **SQL_C_BINARY**.

When you call **SQLFetch**, **SQLExtendedFetch**, or **SQLGetData** to retrieve this kind of data from a data source, Informix ODBC Driver retrieves the data and transfers it, without conversion, to a storage location of type **SQL_C_BINARY**. When you call **SQLExecute**, **SQLExecDirect**, or **SQLPutData** to send this kind of data to a target data source, Informix ODBC Driver retrieves the data from the storage location and transfers it, without conversion, to the target data source.

IDS & IDS/UD



The binary representation of **INT8** and **SERIAL8** is an array of two unsigned long integers followed by a short integer that indicates the sign field. The sign field is 1 for a positive value, -1 for a negative value, or 0 for a null value. ♦

Important: Applications that transfer any data (except binary data) in this manner are not interoperable among DBMSs.

Converting Data

The word *convert* is used in this section in a broad sense; it includes the transfer of data from one storage location to another without a conversion in data type.

Standard Conversions

The following table shows the supported conversions between the Informix SQL data types and the Informix ODBC Driver C data types. A solid circle (●) indicates a supported conversion.

IDS & IDS/UD

Only Dynamic Server and Dynamic Server with UD Option can convert data to SQL_C_BIT. ♦

Informix ODBC Driver C Data Type (Target Type)

Informix SQL Data Type	SQL_C_BINARY	SQL_C_BIT	SQL_C_CHAR	SQL_C_DATE	SQL_C_DOUBLE	SQL_C_FLOAT	SQL_C_LONG	SQL_C_NUMERIC	SQL_C_SHORT	SQL_C_SLONG	SQL_C_SSHORT	SQL_C_STINYINT	SQL_C_TIMESTAMP	SQL_C_TINYINT	SQL_C_ULONG	SQL_C_USHORT	SQL_C_UTINYINT
BOOLEAN (IDS & IDS / UD)	•	•	•														
BYTE	•		•														
CHAR, CHARACTER	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•
CHARACTER VARYING	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•
DATE	•		•	•									•				
DATETIME	•		•	•									•				
DEC, DECIMAL	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•
DOUBLE PRECISION	•		•		•	•	•	•	•	•	•	•		•	•	•	•
FLOAT	•		•		•	•	•	•	•	•	•	•		•	•	•	•
INT, INTEGER	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•
INT8 (IDS & IDS / UD)	•		•				•	•		•					•		
LVARCHAR (IDS & IDS / UD)	•	•	•	•		•	•		•	•	•	•	•	•	•	•	•
MONEY	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
NUMERIC	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
REAL	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
SERIAL	•		•	•	•	•	•		•	•	•	•	•	•	•	•	•

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Standard Conversions

Informix ODBC Driver C Data Type (Target Type)

Informix SQL Data Type		SQL_C_BINARY	SQL_C_BIT	SQL_C_CHAR	SQL_C_DATE	SQL_C_DOUBLE	SQL_C_FLOAT	SQL_C_LONG	SQL_C_NUMERIC	SQL_C_SHORT	SQL_C_SLONG	SQL_C_SSHORT	SQL_C_STINYINT	SQL_C_TIMESTAMP	SQL_C_TINYINT	SQL_C_ULONG	SQL_C_USHORT	SQL_C_UTINYINT
SERIAL8 (IDS & IDS / UD)	●		●					●	●		●					●		
SMALLFLOAT	●	●	●			●	●	●	●	●	●	●	●		●	●	●	●
SMALLINT	●	●	●			●	●	●	●	●	●	●	●		●	●	●	●
TEXT	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
VARCHAR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

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GLS

Additional Conversions for GLS

The following table shows the supported conversions between the additional Informix SQL data types for GLS and the Informix ODBC Driver C data types. A solid circle (●) indicates a supported conversion.

IDS & IDS/UD

Only Dynamic Server and Dynamic Server with UD Option can convert data to SQL_C_BIT. ♦

Informix ODBC Driver C Data Type (fCType)																
Informix SQL Data Type	SQL_C_BINARY	SQL_C_BIT	SQL_C_CHAR	SQL_C_DATE	SQL_C_DOUBLE	SQL_C_FLOAT	SQL_C_LONG	SQL_C_SHORT	SQL_C_SLONG	SQL_C_SSHORT	SQL_C_STINYINT	SQL_C_TIMESTAMP	SQL_C_TINYINT	SQL_C_ULONG	SQL_C_USHORT	SQL_C_UTINYINT
NCHAR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
NVARCHAR	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

Additional Conversions for Dynamic Server with UD Option

The following table shows the supported conversions between the additional Informix SQL data types for Dynamic Server with UD Option and the Informix ODBC Driver C data types, including the additional Informix ODBC Driver C data type for Dynamic Server with UD Option. A solid circle (●) indicates a supported conversion.

Informix SQL Data Type	Informix ODBC Driver C Data Type (fCType)													
	SQL_C_BINARY	SQL_C_BIT	SQL_C_CHAR	SQL_C_DATE	SQL_C_DOUBLE	SQL_C_FLOAT	SQL_C_LONG	SQL_C_SHORT	SQL_C_SLONG	SQL_C_SSHORT	SQL_C_STINYINT	SQL_C_TIMESTAMP	SQL_C_TINYINT	SQL_C_ULONG
Collection	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DISTINCT	●	●	●	●	●	●	●	●	●	●	●	●	●	●
OPAQUE ^a	●		●											
Row	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Smart large object	●	●	●	●	●	●	●	●	●	●	●	●	●	●

^a Use SQL_C_CHAR to access an OPAQUE value in the external format as a string. Use SQL_C_BINARY to access an OPAQUE value in the internal binary format.

Converting Data from SQL to C

When you call **SQLExtendedFetch**, **SQLFetch**, or **SQLGetData**, Informix ODBC Driver retrieves data from a data source. If necessary, Informix ODBC Driver converts the data from the source data type to the data type that the *TargetType* argument in **SQLBindCol** or the *fCType* argument in **SQLGetData** specifies. Finally, Informix ODBC Driver stores the data in the location pointed to by the *rgbValue* argument in **SQLBindCol** or **SQLGetData**.

The tables in the following sections describe how Informix ODBC Driver converts data that it retrieves from a data source. For a given Informix ODBC Driver SQL data type, the first column of the table lists the legal input values of the *TargetType* argument in **SQLBindCol** and the *fctype* argument in **SQLGetData**. The second column lists the outcomes of a test, often using the *cbValueMax* argument specified in **SQLBindCol** or **SQLGetData**, which Informix ODBC Driver performs to determine whether it can convert the data. For each outcome, the third and fourth columns list the values of the *rgbValue* and *pcbValue* arguments specified in **SQLBindCol** or **SQLGetData** after Informix ODBC Driver tries to convert the data.

The last column lists the SQLSTATE returned for each outcome by **SQLExtendedFetch**, **SQLFetch**, or **SQLGetData**.

If the *TargetType* argument in **SQLBindCol** or the *fctype* argument in **SQLGetData** contains a value for an Informix ODBC Driver C data type that is not shown in the table for a given Informix ODBC Driver SQL data type, **SQLExtendedFetch**, **SQLFetch**, or **SQLGetData** returns SQLSTATE 07006 (Restricted data type attribute violation). If the *fctype* argument or the *TargetType* argument contains a value that specifies a conversion from a driver-specific SQL data type to an Informix ODBC Driver C data type and Informix ODBC Driver does not support this conversion, then **SQLExtendedFetch**, **SQLFetch**, or **SQLGetData** returns SQLSTATE S1C00 (Driver not capable).

Although the tables in this chapter do not show it, the *pcbValue* argument contains SQL_NULL_DATA when the SQL data value is null. When Informix ODBC Driver converts SQL data to character C data, the character count returned in *pcbValue* does not include the null-termination byte. If *rgbValue* is a null pointer, **SQLBindCol** or **SQLGetData** returns SQLSTATE S1009 (Invalid argument value).

The following terms and conventions are used in the tables:

- *Length of data* is the number of bytes of C data that are available to return in *rgbValue*, regardless of whether or not the data is truncated before it returns to the application. For string data, this does not include the null-termination byte.
- *Display size* is the total number of bytes that are needed to display the data in character format.
- Words in *italics* represent function arguments or elements of the Informix ODBC Driver SQL grammar.

Default C Data Types

If you specify `SQL_C_DEFAULT` for the *TargetType* argument in the **SQLBindCol**, the *fCType* argument in the **SQLGetData**, or the *ValueType* argument in **SQLBindParameter**, Informix ODBC Driver uses the C data type of the output or input buffer for the SQL data type of the column or parameter to which the buffer is bound.

Standard Default C Data Types

For each Informix ODBC Driver SQL data type, the following table shows the default C data type.

Informix ODBC Driver SQL Data Type (fSqlType)	Default Informix ODBC Driver C Data Type (fCType)
SQL_BIGINT (IDS & IDS/UD)	SQL_C_CHAR
SQL_BIT (IDS & IDS/UD)	SQL_C_BITS
SQL_CHAR	SQL_C_CHAR
SQL_DATE	SQL_C_DATE
SQL_DECIMAL	SQL_C_CHAR
SQL_DOUBLE	SQL_C_DOUBLE
SQL_INTEGER	SQL_C_SLONG
SQL_LONGVARBINARY	SQL_C_BINARY
SQL_LONGVARCHAR	SQL_C_CHAR
SQL_NUMERIC	SQL_C_NUMERIC
SQL_REAL	SQL_C_FLOAT
SQL_SMALLINT	SQL_C_SSHORT
SQL_TIMESTAMP	SQL_C_TIMESTAMP
SQL_VARCHAR	SQL_C_CHARS

Additional Default C Data Types for Dynamic Server with UD Option

For each additional Informix ODBC Driver SQL data type for Dynamic Server with UD Option, the following table shows the default C data type.

Informix ODBC Driver SQL Data Type (fSqlType)	Default Informix ODBC Driver C Data Type (fCType)
SQL_IFMX_UDT_BLOB	SQL_C_BINARY
SQL_IFMX_UDT_CLOB	SQL_C_BINARY
SQL_INFX_UDT_FIXED	This Informix ODBC Driver SQL data type does not have a default Informix ODBC Driver C data type. Because this Informix ODBC Driver SQL data type can contain binary data or character data, you must bind a variable for this Informix ODBC Driver SQL data type before you fetch a corresponding value. The data type of the bound variable specifies the C data type for the value.
SQL_INFX_UDT_VARYING	This Informix ODBC Driver SQL data type does not have a default Informix ODBC Driver C data type. Because this Informix ODBC Driver SQL data type can contain binary data or character data, you must bind a variable for this Informix ODBC Driver SQL data type before you fetch a corresponding value. The data type of the bound variable specifies the C data type for the value.

SQL to C: Binary

The binary Informix ODBC Driver SQL data type is SQL_LONGVARBINARY. The following table shows the Informix ODBC Driver C data types to which binary SQL data can be converted.

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_BINARY	Length of data $\leq cbValueMax$	Data	Length of data	N / A
	Length of data $> cbValueMax$	Truncated data	Length of data	01004
SQL_C_CHAR	(Length of data) * 2 $< cbValueMax$	Data	Length of data	N / A
	(Length of data) * 2 $\geq cbValueMax$	Truncated data	Length of data	01004

When Informix ODBC Driver converts binary SQL data to character C data, each byte (8 bits) of source data is represented as two ASCII characters. These characters are the ASCII character representation of the number in its hexadecimal form. For example, Informix ODBC Driver converts binary 00000001 to “01” and binary 11111111 to “FF.”

Informix ODBC Driver converts individual bytes to pairs of hexadecimal digits and terminates the character string with a null byte. Because of this conversion, if *cbValueMax* is even and is less than the length of the converted data, the last byte of the *rgbValue* buffer is not used. (The converted data requires an even number of bytes, the next-to-last byte is a null byte, and the last byte cannot be used.)

SQL to C: Boolean

The boolean Informix ODBC Driver SQL data type is SQL_BIT. The following table shows the Informix ODBC Driver C data types to which boolean SQL data can be converted. When Informix ODBC Driver converts boolean SQL data to character C data, the possible values are 0 and 1.

fCType	Test	rgbValue	pcbValue	SQLSTATE5
SQL_C_BINARY	$cbValueMax \leq 1$	Data	1	N / A
	$cbValueMax < 1$	Untouched	Untouched	22003
SQL_C_BIT	Informix ODBC Driver ignores the value of <i>cbValueMax</i> for this conversion. Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.	Data	1 (This is the size of the corresponding C data type.)	N / A
SQL_C_CHAR	$cbValueMax > 1$	Data	1	N / A
	$cbValueMax \leq 1$	Untouched	Untouched	22003

SQL to C: Character

The character Informix ODBC Driver SQL data types are:

- SQL_CHAR
- SQL_LONGVARCHAR
- SQL_VARCHAR

The following table shows the Informix ODBC Driver C data types to which character SQL data can be converted. When Informix ODBC Driver converts character SQL data to numeric, date, or time stamp C data, it ignores leading and trailing spaces.

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_BINARY	Length of data ≤ cbValueMax.	Data	Length of data	N / A
	Length of data > cbValueMax.	Truncated data	Length of data	01004
SQL_C_BIT (IDS & IDS/UD)	Data is 0 or 1.	Data	1	N / A
	Data is greater than 0, less than 2, and not equal to 1.	Truncated data	1	01004
	Data is less than 0 or greater than or equal to 2.	Untouched	Untouched	22003
	Data is not a numeric-literal.	Untouched	Untouched (The size of the corresponding C data type is 1.)	22005
SQL_C_CHAR	Length of data < cbValueMax.	Data	Length of data	N / A
	Length of data ≥ cbValueMax.	Truncated data	Length of data	01004

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fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_DATE	Data value is a valid <i>date-value</i> .	Data	6	N / A
	Data value is a valid <i>timestamp-value</i> ; time portion is zero.	Data	6	N / A
	Data value is a valid <i>timestamp-value</i> ; time portion is non-zero. (Informix ODBC Driver ignores the date portion of <i>timestamp-value</i> .)	Truncated data	6	01004
	Data value is not a valid <i>date-value</i> or <i>timestamp-value</i> .	Untouched	Untouched	22008
	(For all these conversions, Informix ODBC Driver ignores the value of <i>cbValueMax</i> . Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)		(The size of the corresponding C data type is 6.)	
SQL_C_DOUBLE SQL_C_FLOAT	Data is within the range of the data type to which the number is being converted.	Data	Size of the C data type	N / A
	Data is outside the range of the data type to which the number is being converted.	Untouched	Untouched	22003
	Data is not a <i>numeric-literal</i> .	Untouched	Untouched	22005
	(For all these conversions, Informix ODBC Driver ignores the value of <i>cbValueMax</i> . Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)			

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Converting Data from SQL to C

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_LONG SQL_C_SHORT SQL_C_SLONG SQL_C_SSHORT SQL_C_STINYINT SQL_C_TINYINT SQL_C_ULONG SQL_C_USHORT SQL_C_UTINYINT	Data converted without truncation. Data converted with truncation of fractional digits. Conversion of data would result in loss of whole (as opposed to fractional) digits. Data is not a <i>numeric-literal</i> . (For all these conversions, Informix ODBC Driver ignores the value of <i>cbValueMax</i> . Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)	Data Truncated data Untouched Untouched	Size of the C data type Size of the C data type Untouched Untouched	N / A 01004 22003 22005

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fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_TIMESTAMP	Data value is a valid <i>timestamp-value</i> ; fractional seconds portion not truncated.	Data	16	N / A
	Data value is a valid <i>timestamp-value</i> ; fractional seconds portion truncated.	Truncated data	16	N / A
	Data value is a valid <i>date-value</i> .	Data (Informix ODBC Driver sets the time fields of the time stamp structure to zero.)	16	N / A
	Data value is a valid <i>time-value</i> .	Data (Informix ODBC Driver sets the date fields of the time stamp structure to the current date.)	16	N / A
	Data value is not a valid <i>date-value</i> , <i>time-value</i> , or <i>timestamp-value</i> .	Untouched	Untouched	22008
	(For all these conversions, Informix ODBC Driver ignores the value of <i>cbValueMax</i> . Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)		(The size of the corresponding C data type is 16.)	

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SQL to C: Date

The date Informix ODBC Driver SQL data type is SQL_DATE. The following table shows the Informix ODBC Driver C data types to which date SQL data can be converted. When Informix ODBC Driver converts date SQL data to character C data, the resulting string is in the “yyyy-mm-dd” format.

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_BINARY	Length of data ≤ cbValueMax	Data	Length of data	N / A
	Length of data > cbValueMax	Untouched	Untouched	22003
SQL_C_CHAR	cbValueMax ≥ 11	Data	10	N / A
	cbValueMax < 11	Untouched	Untouched	22003
SQL_C_DATE	Informix ODBC Driver ignores the value of cbValueMax for this conversion. Informix ODBC Driver uses the size of rgbValue for the size of the C data type.	Data	6 (This is the size of the corresponding C data type.)	N / A
SQL_C_TIMESTAMP	Informix ODBC Driver ignores the value of cbValueMax for this conversion. Informix ODBC Driver uses the size of rgbValue for the size of the C data type.	Data (Informix ODBC Driver sets the time fields of the time stamp structure to zero.)	16 (This is the size of the corresponding C data type.)	N / A

SQL to C: Numeric

The numeric Informix ODBC Driver SQL data types are:

- SQL_DECIMAL
- SQL_DOUBLE
- SQL_INTEGER
- SQL_REAL
- SQL_SMALLINT

The following table shows the Informix ODBC Driver C data types to which numeric SQL data can be converted.

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_BINARY	Length of data $\leq$ <i>cbValueMax</i> .	Data	Length of data	N / A
	Length of data $>$ <i>cbValueMax</i> .	Untouched	Untouched	22003
SQL_C_BIT (IDS & IDS/UD)	Data is 0 or 1.	Data	1	N / A
	Data is greater than 0, less than 2, and not equal to 1.	Truncated data	1	01004
	Data is less than 0 or greater than or equal to 2.	Untouched	Untouched	22003
	Data is not a <i>numeric-literal</i> .	Untouched	Untouched (The size of the corresponding C data type is 1.)	22005
SQL_C_CHAR	Display size $<$ <i>cbValueMax</i> .	Data	Length of data	N / A
	Number of whole (as opposed to fractional) digits $<$ <i>cbValueMax</i> .	Truncated data	Length of data	01004
	Number of whole (as opposed to fractional) digits $\geq$ <i>cbValueMax</i> .	Untouched	Untouched	22003

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Converting Data from SQL to C

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_DOUBLE SQL_C_FLOAT	Data is within the range of the data type to which the number is being converted. Data is outside the range of the data type to which the number is being converted. (Informix ODBC Driver ignores the value of <i>cbValueMax</i> for this conversion. Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)	Data Untouched	Size of the C data type Untouched	N / A 22003
SQL_C_LONG SQL_C_SHORT SQL_C_SLONG SQL_C_SSHORT SQL_C_STINYINT SQL_C_TINYINT SQL_C_ULONG SQL_C_USHORT SQL_C_UTINYINT	Data converted without truncation. Data converted with truncation of fractional digits. Conversion of data would result in loss of whole (as opposed to fractional) digits. (Informix ODBC Driver ignores the value of <i>cbValueMax</i> for this conversion. Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)	Data Truncated data Untouched	Size of the C data type Size of the C data type Untouched	N / A 01004 22003

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SQL to C: Time Stamp

The time-stamp Informix ODBC Driver SQL data type is SQL_TIMESTAMP. The following table shows the Informix ODBC Driver C data types to which time stamp SQL data can be converted.

fCType	Test	rgbValue	pcbValue	SQLSTATE
SQL_C_BINARY	Length of data $\leq$ <i>cbValueMax</i> .	Data	Length of data	N / A
	Length of data $>$ <i>cbValueMax</i> .	Untouched	Untouched	22003
SQL_C_CHAR	<i>cbValueMax</i> $>$ Display size.	Data	Length of data	N / A
	$20 \leq$ <i>cbValueMax</i> $\leq$ Display size.	Truncated data (Informix ODBC Driver truncates the fractional seconds portion of the time stamp.)	Length of data	01004
	<i>cbValueMax</i> $<$ 20.	Untouched	Untouched	22003
SQL_C_DATE	Time portion of time stamp is zero.	Data	6	N / A
	Time portion of time stamp is nonzero.	Truncated data	6	01004
	(Informix ODBC Driver ignores the value of <i>cbValueMax</i> for this conversion. Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)	(Informix ODBC Driver truncates the time portion of the time stamp.)	(The size of the corresponding C data type is 6.)	
SQL_C_TIMESTAMP	Fractional seconds portion of time stamp is not truncated.	Data	16	N / A
	Fractional seconds portion of time stamp is truncated.	Truncated data	16	01004
	(Informix ODBC Driver ignores the value of <i>cbValueMax</i> for this conversion. Informix ODBC Driver uses the size of <i>rgbValue</i> for the size of the C data type.)	(Informix ODBC Driver truncates the fractional seconds portion of the time stamp.)	(The size of the corresponding C data type is 16.)	

When Informix ODBC Driver converts time stamp SQL data to character C data, the resulting string is in the “yyyy-mm-dd hh:mm:ss[f...]” format, where up to nine digits can be used for fractional seconds. Except for the decimal point and fractional seconds, the entire format must be used, regardless of the precision of the time stamp SQL data type.

SQL-to-C Data Conversion Examples

The following table illustrates how Informix ODBC Driver converts SQL data to C data. “\0” represents a null-termination byte. Informix ODBC Driver always null-terminates SQL_C_CHAR data. For the combination of SQL_DATE and SQL_C_TIMESTAMP, Informix ODBC Driver stores the numbers that are in the *rgbValue* column in the fields of the *TIMESTAMP_STRUCT* structure.

SQL Data Type	SQL Data Value	C Data Type	cbValueMax	rgbValue	SQLSTATE
SQL_CHAR	tigers	SQL_C_CHAR	7	tigers\0	N / A
SQL_CHAR	tigers	SQL_C_CHAR	6	tiger\0	01004
SQL_DECIMAL	1234.56	SQL_C_CHAR	8	1234.56\0	N / A
SQL_DECIMAL	1234.56	SQL_C_CHAR	5	1234\0	01004
SQL_DECIMAL	1234.56	SQL_C_CHAR	4	—	22003
SQL_DECIMAL	1234.56	SQL_C_FLOAT	Ignored	1234.56	N / A
SQL_DECIMAL	1234.56	SQL_C_SSHORT	Ignored	1234	01004
SQL_DECIMAL	1234.56	SQL_C_STINYINT	Ignored	—	22003
SQL_DOUBLE	1.2345678	SQL_C_DOUBLE	Ignored	1.2345678	N / A
SQL_DOUBLE	1.2345678	SQL_C_FLOAT	Ignored	1.234567	N / A
SQL_DOUBLE	1.2345678	SQL_C_STINYINT	Ignored	1	N / A
SQL_DATE	1992-12-31	SQL_C_CHAR	11	1992-12-31\0	N / A
SQL_DATE	1992-12-31	SQL_C_CHAR	10	—	22003
SQL_DATE	1992-12-31	SQL_C_TIMESTAMP	Ignored	1992,12,31, 0,0,0,0	N / A

SQL Data Type	SQL Data Value	C Data Type	cbValueMax	rgbValue	SQLSTATE
SQL_TIMESTAMP	1992-12-31 23:45:55.12	SQL_C_CHAR	23	1992-12-31 23:45:55.12\0	N / A
SQL_TIMESTAMP	1992-12-31 23:45:55.12	SQL_C_CHAR	22	1992-12-31 23:45:55.1\0	01004
SQL_TIMESTAMP	1992-12-31 23:45:55.12	SQL_C_CHAR	18	—	22003

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Converting Data from C to SQL

When you call **SQLExecute** or **SQLExecDirect**, Informix ODBC Driver retrieves the data for parameters that are bound with **SQLBindParameter** from storage locations in the application. For data-at-execution parameters, call **SQLPutData** to send the parameter data. If necessary, Informix ODBC Driver converts the data from the data type that the *ValueType* argument specifies in **SQLBindParameter** to the data type that the *fSqlType* argument specifies in **SQLBindParameter**. Finally, Informix ODBC Driver sends the data to the data source.

The tables in the following sections describe how Informix ODBC Driver converts data that it sends to the data source. For a given Informix ODBC Driver C data type, the first column of the table lists the legal input values of the *fSqlType* argument in **SQLBindParameter**. The second column lists the outcomes of a test that Informix ODBC Driver performs to determine whether it can convert the data. The third column lists the SQLSTATE that is returned for each outcome by **SQLExecDirect**, **SQLExecute**, or **SQLPutData**. Data is sent to the data source only if SQL_SUCCESS is returned.

If the *fSqlType* argument in **SQLBindParameter** contains a value for an Informix ODBC Driver SQL data type that is not shown in the table for a given C data type, then **SQLBindParameter** returns SQLSTATE 07006 (Restricted data type attribute violation).

If the *rgbValue* and *pcbValue* arguments specified in **SQLBindParameter** are both null pointers, then that function returns SQLSTATE S1009 (Invalid argument value). To specify a null SQL data value, set the value that the *pcbValue* argument of **SQLBindParameter** points to or the value of the *cbValue* argument to SQL_NULL_DATA. To specify that the value in *rgbValue* is a null-terminated string, set these values to SQL_NTS.

The following terms are used in the tables:

- *Length of data* is the number of bytes of SQL data that are available to send to the data source, regardless of whether the data is truncated before it goes to the data source. For string data, this does not include the null-termination byte.
- *Column length* and *display size* are defined for each SQL data type in [“Precision, Scale, Length, and Display Size” on page 4-9](#).
- *Number of digits* is the number of characters that represent a number, including the minus sign, decimal point, and exponent (if needed).
- Words in *italics* represent elements of the Informix ODBC Driver SQL syntax.

C to SQL: Binary

The binary Informix ODBC Driver C data type is SQL_C_BINARY. The following table shows the Informix ODBC Driver SQL data types to which binary C data can be converted. In the Test column, the SQL data length is the number of bytes needed to store the data on the data source. This may be different from the column length, as defined in [“Precision, Scale, Length, and Display Size” on page 4-9](#).

fSqlType	Test	SQLSTATE
SQL_BIGINT (IDS & IDS/UD)	Length of data = SQL data length.	N / A
	Length of data ≠ SQL data length.	22003
SQL_BIT (IDS & IDS/UD)	Length of data = SQL data length.	N / A
	Length of data ≠ SQL data length.	22003
SQL_CHAR SQL_LONGVARCHAR SQL_VARCHAR	Length of data ≤ Column length.	N / A
	Length of data > Column length.	01004

(1 of 2)

fSqlType	Test	SQLSTATE
SQL_DATE	Length of data = SQL data length.	N / A
SQL_TIMESTAMP	Length of data $\neq$ SQL data length.	22003
SQL_DECIMAL	Length of data = SQL data length.	N / A
SQL_DOUBLE	Length of data $\neq$ SQL data length.	22003
SQL_INTEGER		
SQL_REAL		
SQL_SMALLINT		
SQL_LONGVARBINARY	Length of data $\leq$ Column length.	N / A
	Length of data $>$ Column length.	01004

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C to SQL: Bit

The bit Informix ODBC Driver C data type is SQL_C_BIT. The following table shows the Informix ODBC Driver SQL data types to which bit C data can be converted.

fSqlType	Test	SQLSTATE
SQL_BIGINT	None	N / A
SQL_DECIMAL		
SQL_DOUBLE		
SQL_INTEGER		
SQL_REAL		
SQL_SMALLINT		
SQL_BIT	None	N / A
SQL_CHAR	None	N / A
SQL_LONGVARCHAR		
SQL_VARCHAR		

Informix ODBC Driver ignores the value that the *pcbValue* argument of **SQLBindParameter** points to and the value of the *cbValue* argument of **SQLPutData** when it converts data from the boolean C data type. Informix ODBC Driver uses the size of *rgbValue* for the size of the boolean C data type.

C to SQL: Character

The character Informix ODBC Driver C data type is SQL_C_CHAR. The following table shows the Informix ODBC Driver SQL data types to which C character data can be converted.

fSqlType	Test	SQLSTATE
SQL_BIGINT (IDS & IDS/UD)	Data converted without truncation.	N / A
	Data converted with truncation of fractional digits.	01004
	Conversion of data would result in loss of whole (as opposed to fractional) digits.	22003
	Data value is not a <i>numeric-literal</i> .	22005
SQL_BIT (IDS & IDS/UD)	Data is 0 or 1.	N / A
	Data is greater than 0, less than 2, and not equal to 1.	01004
	Data is less than 0 or greater than or equal to 2.	22003
	Data is not a <i>numeric-literal</i> .	22005
SQL_CHAR SQL_LONGVARCHAR SQL_VARCHAR	Length of data ≤ Column length.	N / A
	Length of data > Column length.	01004
SQL_DATE	Data value is a valid Informix ODBC Driver <i>date-literal</i> .	N / A
	Data value is a valid Informix ODBC Driver <i>timestamp-literal</i> ; time portion is zero.	N / A
	Data value is a valid Informix ODBC Driver <i>timestamp-literal</i> ; time portion is non-zero. Informix ODBC Driver truncates the time portion of the time stamp.	01004
	Data value is not a valid Informix ODBC Driver <i>date-literal</i> or Informix ODBC Driver <i>timestamp-literal</i> .	22008

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fSqlType	Test	SQLSTATE
SQL_DECIMAL SQL_INTEGER SQL_SMALLINT	Data converted without truncation.	N / A
	Data converted with truncation of fractional digits.	01004
	Conversion of data would result in loss of whole (as opposed to fractional) digits.	22003
	Data value is not a <i>numeric-literal</i> .	22005
SQL_DOUBLE SQL_REAL	Data is within the range of the data type to which the number is being converted.	N / A
		22003
	Data is outside the range of the data type to which the number is being converted.	22005
	Data value is not a <i>numeric-literal</i> .	
SQL_LONGVARBINARY	(Length of data) / 2 ≤ Column length.	N / A
	(Length of data) / 2 > Column length.	01004
	Data value is not a hexadecimal value.	22005
SQL_TIMESTAMP	Data value is a valid Informix ODBC Driver <i>timestamp-literal</i> ; fractional seconds portion not truncated.	N / A
	Data value is a valid Informix ODBC Driver <i>timestamp-literal</i> ; fractional seconds portion truncated.	01004
	Data value is a valid Informix ODBC Driver <i>date-literal</i> . Informix ODBC Driver sets the time portion of the time stamp to zero.	N / A
		N / A
	Data value is a valid Informix ODBC Driver <i>time-literal</i> . Informix ODBC Driver sets the date portion of the time stamp to the current date.	22008
	Data value is not a valid Informix ODBC Driver <i>date-literal</i> , Informix ODBC Driver <i>time-literal</i> , or Informix ODBC Driver <i>timestamp-literal</i> .	

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When Informix ODBC Driver converts character C data to numeric, date, or time stamp SQL data, it ignores leading and trailing blanks. When Informix ODBC Driver converts character C data to binary SQL data, it converts each two bytes of character data to one byte of binary data. Each two bytes of character data represent a number in hexadecimal form. For example, Informix ODBC Driver converts “01” to binary 00000001 and “FF” to binary 11111111.

Informix ODBC Driver always converts pairs of hexadecimal digits to individual bytes and ignores the null-termination byte. Because of this conversion, if the length of the character string is odd, the last byte of the string (excluding the null termination byte, if any) is not converted.

C to SQL: Date

The date Informix ODBC Driver C data type is SQL_C_DATE. The following table shows the Informix ODBC Driver SQL data types to which date C data can be converted.

fSqlType	Test	SQLSTATE
SQL_CHAR SQL_LONGVARCHAR SQL_VARCHAR	Column length $\geq$ 10.	N / A
	Column length < 10.	22003
	Data value is not a valid date.	22008
SQL_DATE	Data value is a valid date.	N / A
	Data value is not a valid date.	22008
SQL_TIMESTAMP	Data value is a valid date. Informix ODBC Driver sets the time portion of the time stamp to zero.	N / A
	Data value is not a valid date.	22008

When Informix ODBC Driver converts date C data to character SQL data, the resulting character data is in the “yyyy-mm-dd” format.

Informix ODBC Driver ignores the value that the *pcbValue* argument of **SQLBindParameter** points to and the value of the *cbValue* argument of **SQLPutData** when it converts data from the date C data type. Informix ODBC Driver uses the size of *rgbValue* for the size of the date C data type.

C to SQL: Numeric

The numeric Informix ODBC Driver C data types are:

- SQL_C_DOUBLE
- SQL_C_FLOAT
- SQL_C_LONG
- SQL_C_SHORT
- SQL_C_SLONG
- SQL_C_STINYINT
- SQL_C_TINYINT
- SQL_C_ULONG
- SQL_C_USHORT
- SQL_C_UTINYINT

The following table shows the Informix ODBC Driver SQL data types to which numeric C data can be converted.

fSqlType	Test	SQLSTATE
SQL_BIGINT (IDS & IDS/UD)	Data converted without truncation.	N / A
	Data converted with truncation of fractional digits.	01004
	Conversion of data would result in loss of whole (as opposed to fractional) digits.	22003
SQL_BIT (IDS & IDS/UD)	Data is 0 or 1.	N / A
	Data is greater than 0, less than 2, and not equal to 1.	01004
	Data is less than 0 or greater than or equal to 2.	22003

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fSqlType	Test	SQLSTATE
SQL_CHAR	Number of digits $\leq$ Column length.	N / A
SQL_LONGVARCHAR	Number of whole (as opposed to fractional) digits $\leq$ Column length.	01004
SQL_VARCHAR	Number of whole (as opposed to fractional) digits $>$ Column length.	22003
SQL_DECIMAL	Data converted without truncation.	N / A
SQL_INTEGER	Data converted with truncation of fractional digits.	01004
SQL_SMALLINT	Conversion of data would result in loss of whole (as opposed to fractional) digits.	22003
SQL_DOUBLE	Data is within the range of the data type to which the number is being converted.	N / A
SQL_REAL	Data is outside the range of the data type to which the number is being converted.	22003

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Informix ODBC Driver ignores the value that the *pcbValue* argument of **SQLBindParameter** points to and the value of the *cbValue* argument of **SQLPutData** when it converts data from the numeric C data types. Informix ODBC Driver uses the size of *rgbValue* for the size of the numeric C data type.

C to SQL: Time Stamp

The time stamp Informix ODBC Driver C data type is SQL_C_TIMESTAMP. The following table shows the Informix ODBC Driver SQL data types to which time stamp C data can be converted.

fSqlType	Test	SQLSTATE
SQL_CHAR SQL_LONGVARCHAR SQL_VARCHAR	Column length $\geq$ Display size.	N / A
	$19 \leq$ Column length $<$ Display size. Informix ODBC Driver truncates the fractional seconds of the time stamp.	01004
	Column length < 19 .	22003
	Data value is not a valid date.	22008
SQL_DATE	Time fields are zero.	N / A
	Time fields are non-zero. Informix ODBC Driver truncates the time fields of the time stamp structure.	01004
	Data value does not contain a valid date.	22008
SQL_TIMESTAMP	Fractional seconds fields are not truncated.	N / A
	Fractional seconds fields are truncated. Informix ODBC Driver truncates the fractional seconds fields of the time stamp structure.	01004
		22008
	Data value is not a valid time stamp.	

When Informix ODBC Driver converts time stamp C data to character SQL data, the resulting character data is in the “yyyy-mm-dd hh:mm:ss[f...]” format.

Informix ODBC Driver ignores the value that the *pcbValue* argument of **SQLBindParameter** points to and the value of the *cbValue* argument of **SQLPutData** when it converts data from the time stamp C data type. Informix ODBC Driver uses the size of *rgbValue* for the size of the time stamp C data type.

C-to-SQL Data Conversion Examples

The following table illustrates how Informix ODBC Driver converts C data to SQL data. “\0” represents a null-termination byte. The null-termination byte is required only if the length of the data is SQL_NTS. For SQL_C_DATE, the numbers that are in the C Data Value column are the numbers that are stored in the fields of the DATE_STRUCT structure. For SQL_C_TIMESTAMP, the numbers that are in the C Data Value column are the numbers that are stored in the fields of the TIMESTAMP_STRUCT structure.

C Data Type	C Data Value	SQL Data Type	Column Length	SQL Data Value	SQLSTATE
SQL_C_CHAR	tigers\0	SQL_CHAR	6	tigers	N / A
SQL_C_CHAR	tigers\0	SQL_CHAR	5	tiger	01004
SQL_C_CHAR	1234.56\0	SQL_DECIMAL	8 (In addition to bytes for numbers, one byte is required for a sign and another for the decimal point.)	1234.56	N / A
SQL_C_CHAR	1234.56\0	SQL_DECIMAL	7 (In addition to bytes for numbers, one byte is required for a sign and another for the decimal point.)	1234.5	01004
SQL_C_CHAR	1234.56\0	SQL_DECIMAL	4	—	22003
SQL_C_FLOAT	1234.56	SQL_FLOAT	not applicable	1234.56	N / A
SQL_C_FLOAT	1234.56	SQL_INTEGER	not applicable	1234	01004
SQL_C_FLOAT	1234.56	SQL_TINYINT	not applicable	—	22003
SQL_C_DATE	1992,12,31	SQL_CHAR	10	1992-12-31	N / A
SQL_C_DATE	1992,12,31	SQL_CHAR	9	—	22003

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C Data Type	C Data Value	SQL Data Type	Column Length	SQL Data Value	SQLSTATE
SQL_C_DATE	1992,12,31	SQL_TIMESTAMP	not applicable	1992-12-31 00:00:00.0	N / A
SQL_C_TIMESTAMP	1992,12,31, 23,45,55, 120000000	SQL_CHAR	22	1992-12-31 23:45:55.12	N / A
SQL_C_TIMESTAMP	1992,12,31, 23,45,55, 120000000	SQL_CHAR	21	1992-12-31 23:45:55.1	01004
SQL_C_TIMESTAMP	1992,12,31, 23,45,55, 120000000	SQL_CHAR	18	—	22003

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Working with Smart Large Objects

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In This Chapter

The information in this chapter applies only if your database server is Informix Dynamic Server with Universal Data Option.

This chapter describes how to store, create, and access a smart large object; how to transfer smart-large-object data; how to retrieve the status of a smart large object; and how to read or write a smart large object to or from a file.

A smart large object is a recoverable large object that is stored in an sbspace on disk. You can access a smart large object with read, write, and seek operations similar to an operating-system file. The two data types for smart large objects are *character large object* (CLOB) and *binary large object* (BLOB). A CLOB consists of text data and a BLOB consists of binary data in an undifferentiated byte stream.

For more information about smart-large-object data types, see [Chapter 4, “Data Types,”](#) and the *Informix Guide to SQL: Reference*. For information about the client functions that you use to access smart large objects, see [Chapter 7, “Client Functions.”](#)

Working with Data Structures for Smart Large Objects

A smart large object can be huge. Therefore, instead of storing the content of a smart large object in a database table, Dynamic Server with UD Option does the following:

- Stores the content of the smart large object in an sbspace
- Stores a pointer to the smart large object in the database table

Because a smart large object can be huge, an Informix ODBC Driver application cannot receive a smart large object in a variable. Instead, the application sends or receives information about the smart large object in a data structure. The following table describes the data structures that Informix ODBC Driver uses for smart large objects.

Data Structure	Name	Description
lofd	Smart-large-object file descriptor	Provides access to a smart large object. Uses a file descriptor to access smart-large-object data as if it were in an operating-system file.
loptr	Smart-large-object pointer structure	Provides security information and a pointer to a smart large object. This structure is the data that Dynamic Server with UD Option stores in a database table for a smart large object. Therefore, SQL statements such as INSERT and SELECT accept a smart-large-object pointer structure as a value for a column or a parameter that has a data type of smart large object.
lospec	Smart-large-object specification structure	Specifies the storage characteristics for a smart large object.
lostat	Smart-large-object status structure	Stores status information for a smart large object. Normally you can fetch a user-defined data type (UDT) in either binary or character representation. However, it is not possible to convert a smart-large-object status structure to character representation. Therefore, you need to use SQL_C_BINARY as the Informix ODBC Driver C data type for lostat .



Important: These data structures are opaque to Informix ODBC Driver applications and their internal structures might change. Therefore, do not access the internal structures directly. Use the smart-large-object client functions to manipulate the data structures.

The application is responsible for allocating space for these smart-large-object data structures.

To work with a smart-large-object data structure

1. Determine the size of the smart-large-object structure.
2. Use either a fixed size array or a dynamically allocated buffer that is at least the size of the data structure.
3. Free the array or buffer space when you are done using it.

The following code example illustrates these steps:

```
rc = SQLGetInfo(hdbc, SQL_INFX_LO_SPEC_LENGTH, &lospec_size,
               sizeof(lospec_size), NULL);
lospec_buffer = malloc(lospec_size);
:
free(lospec_buffer);
```

Handling the Storage of Smart Large Objects

The smart-large-object specification structure stores the following storage characteristics for a smart large object:

- Disk-storage information
- Create-time flags

Disk-Storage Information

Disk-storage information helps Dynamic Server with UD Option determine how to store the smart large object most efficiently on disk. The following table describes the types of disk-storage information and the corresponding client functions. For most applications, Informix recommends that you use the values for the disk-storage information that the database server determines.

Disk-Storage Information	Description	Client Functions
Estimated size	An estimate of the final size, in bytes, of the smart large object. Dynamic Server with UD Option uses this value to determine the extents in which to store the smart large object. This value provides optimization information. If the value is grossly incorrect, it does not cause incorrect behavior. However, it does mean that the database server might not necessarily choose optimal extent sizes for the smart large object.	ifx_lo_specget_estbytes() ifx_lo_specset_estbytes()
Maximum size	The maximum size, in bytes, for the smart large object. Dynamic Server with UD Option does not allow the smart large object to grow beyond this size.	ifx_lo_specget_maxbytes() ifx_lo_specset_maxbytes()
Allocation extent size	The allocation extent size is specified in kilobytes. Optimally, the allocation extent is the single extent in a chunk that holds all the data for the smart large object. Dynamic Server with UD Option performs storage allocations for smart large objects in increments of the allocation extent size. It tries to allocate an allocation extent as a single extent in a chunk. However, if no single extent is large enough, the database server must use multiple extents as necessary to satisfy the request.	ifx_lo_specget_extsz() ifx_lo_specset_extsz()
Name of the sbspace	The name of the sbspace that contains the smart large object. On Dynamic Server with UD Option, an sbspace name can be up to 128 characters long and must be null terminated.	ifx_lo_specget_sbspace() ifx_lo_specset_sbspace()

Create-Time Flags

Create-time flags tell Dynamic Server with UD Option what options to assign to the smart large object. The following table describes the create-time flags.

Type of Indicator	Create-Time Flag	Description
Logging	LO_LOG	Tells Dynamic Server with UD Option to log changes to the smart large object in the system log file. Consider carefully whether to use the LO_LOG flag value. The database server incurs considerable overhead to log smart large objects. You must also make sure that the system log file is large enough to hold the value of the smart large object. For more information, see your Administrator's Guide.
	LO_NOLOG	Tells Dynamic Server with UD Option to turn off logging for all operations that involve the associated smart large object.
Last access-time	LO_KEEP_LASTACCESS_TIME	Tells Dynamic Server with UD Option to save the last access time for the smart large object. This access time is the time of the last read or write operation. Consider carefully whether to use the LO_KEEP_LASTACCESS_TIME flag value. The database server incurs considerable overhead to maintain last access times for smart large objects.
	LO_NOKEEP_LASTACCESS_TIME	Tells Dynamic Server with UD Option not to maintain the last access time for the smart large object.

The **ifx_lo_specset_flags()** function sets the create-time flags to a new value. The **ifx_lo_specget_flags()** function retrieves the current value of the create-time flag.

Logging indicators and the last access-time indicators are stored in the smart-large-object specification structure as a single flag value. To set a flag from each group, use the C-language OR operator to mask the two flag values together. However, masking mutually exclusive flags causes an error. If you do not specify a value for one of the flag groups, the database server uses the inheritance hierarchy to determine this information.

Inheritance Hierarchy

Dynamic Server with UD Option uses an inheritance hierarchy to obtain storage characteristics. [Figure 5-1](#) shows the inheritance hierarchy for smart-large-object storage characteristics.

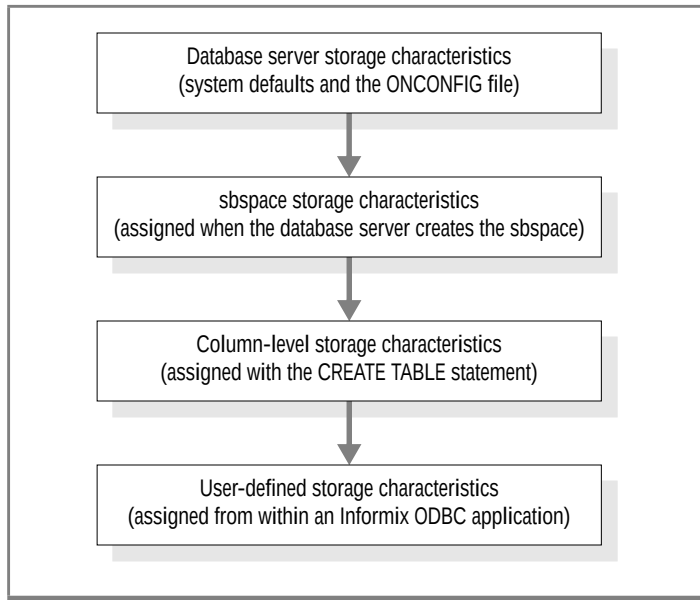


Figure 5-1
*Inheritance
Hierarchy for
Storage
Characteristics*

System-Specified Storage Characteristics

Dynamic Server with UD Option uses one of the following sets of storage characteristics as the system-specified storage characteristics:

- If the sbspace in which the smart large object is stored specifies a value for a particular storage characteristic, the database server uses the sbspace value as the system-specified storage characteristic.
The database administrator can use the **onspaces** utility to define storage characteristics for an sbspace.
- If the sbspace in which the smart large object is stored does not specify a value for a particular storage characteristic, the database server uses the system default as the system-specified storage characteristic.

The database server defines the system defaults for storage characteristics internally. However, you can specify a default sbspace name with the SBSPACENAME configuration parameter in the ONCONFIG file. Also, an application call to **ifx_lo_col_info()** or **ifx_lo_specset_sbspace()** can supply the target sbspace in the smart-large-object specification structure.



Warning: An error will occur if the SBSPACENAME configuration parameter is not specified and the smart-large-object specification structure does not contain the name of the target sbspace.

Informix recommends that you use the system-specified storage characteristics for the disk-storage information. For more information about sbspaces and the description of the **onspaces** utility, see your [Administrator's Guide](#).

To use system-specified storage characteristics for a new smart large object

1. Call **ifx_lo_def_create_spec()** to allocate a smart-large-object specification structure and to initialize the structure to null values.
2. Call **ifx_lo_create()** to create an instance of the smart large object.

Column-Level Storage Characteristics

The CREATE TABLE statement assigns storage characteristics to a database column. The PUT clause of the CREATE TABLE statement specifies storage characteristics for a smart-large-object column. The **syscolattns** system catalog table stores the column-level storage characteristics.

To use column-level storage characteristics for a new smart-large-object instance

1. Call **ifx_lo_def_create_spec()** to allocate a smart-large-object specification structure and initialize this structure to null values.
2. Call **ifx_lo_col_info()** to retrieve the column-level storage characteristics and store them in the specified smart-large-object specification structure.
3. Call **ifx_lo_create()** to create an instance of the smart large object.

User-Defined Storage Characteristics

You can define a unique set of storage characteristics for a new smart large object, as follows:

- For a smart large object that will be stored in a column, you can override some storage characteristics for the column when you create an instance of a smart large object.
If you do not override some or all of these characteristics, the smart large object uses the column-level storage characteristics.
- You can specify a wider set of characteristics for a smart large object because a smart large object is not constrained by table column properties.
If you do not override some or all of these characteristics, the smart large object inherits the system-specified storage characteristics.

To specify user-defined storage characteristics, call an **ifx_lo_specset_*** function.

Creating a Smart Large Object

The following code example, **lcreate.c**, shows how to create a smart large object. You can find the **lcreate.c** file in the **%INFORMIXDIR%\demo\clidemo** directory on UNIX platforms and in the **%INFORMIXDIR%\demo\odbcdemo** directory in Windows environments. You can also find instructions on how to build the **odbc_demo** database in the same location.

```

/*
**      lcreate.c
**
**      To create a smart large object
**
**      ODBC Functions:
**      SQLAllocHandle
**      SQLBindParameter
**      SQLConnect
**      SQLFreeStmt
**      SQLGetInfo
**      SQLDisconnect
**      SQLExecDirect
**
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef NO_WIN32
#include <io.h>
#include <windows.h>
#include <conio.h>
#endif /*NO_WIN32*/

#include "infxccli.h"

#define BUFFER_LEN      12
#define ERRMSG_LEN      200

UCHAR   defDsn[] = "odbc_demo";

int checkError (SQLRETURN      rc,
                SQLSMALLINT    handleType,
                SQLHANDLE      handle,
                char            *errmsg)
{
    SQLRETURN      retcode = SQL_SUCCESS;

```

Creating a Smart Large Object

```
SQLSMALLINT    errNum = 1;
SQLCHAR        sqlState[6];
SQLINTEGER     nativeError;
SQLCHAR        errMsg[ERRMSG_LEN];
SQLSMALLINT    textLengthPtr;

if ((rc != SQL_SUCCESS) && (rc != SQL_SUCCESS_WITH_INFO))
{
    while (retcode != SQL_NO_DATA)
    {
        retcode = SQLGetDiagRec (handleType, handle, errNum, sqlState,
                                &nativeError, errMsg, ERRMSG_LEN, &textLengthPtr);

        if (retcode == SQL_INVALID_HANDLE)
        {
            fprintf (stderr, "checkError function was called with an invalid
                           handle!!\n");
            return 1;
        }

        if ((retcode == SQL_SUCCESS) || (retcode == SQL_SUCCESS_WITH_INFO))
            fprintf (stderr, "ERROR: %d:  %s : %s \n", nativeError, sqlState,
                    errMsg);

        errNum++;
    }

    fprintf (stderr, "%s\n", errMsg);
    return 1;  /* all errors on this handle have been reported */
}
else
    return 0;  /* no errors to report */
}

int main (long        argc,
          char        *argv[])
{
    /* Declare variables
    */

    /* Handles */
    SQLHDBC    hdbc;
    SQLHENV    henv;
    SQLHSTMT    hstmt;

    /* Smart large object file descriptor */
    long        lofd;
    long        lofd_valsize = 0;
```

```

/* Smart large object pointer structure */
char*      loptr_buffer;
short      loptr_size;
long       loptr_valsize = 0;

/* Smart large object specification structure */
char*      lospec_buffer;
short      lospec_size;
long       lospec_valsize = 0;

/* Write buffer */
char*      write_buffer;
short      write_size;
long       write_valsize = 0;

/* Miscellaneous variables */
UCHAR      dsn[20]; /*name of the DSN used for connecting to the database*/
SQLRETURN  rc = 0;
int        in;

FILE*      hfile;
char*      lo_file_name = "advert.txt";

char        colname[BUFFER_LEN] = "item.advert";
long       colname_size = SQL_NTS;

long        mode = LO_RDWR;
long        cbMode = 0;

char*      insertStmt = "INSERT INTO item VALUES (1005, 'Helmet', 235, 'Each',
                        ?, '39.95')";

/* STEP 1. Get data source name from command line (or use default)
**      Allocate environment handle and set ODBC version
**      Allocate connection handle
**      Establish the database connection
**      Allocate the statement handle
*/

/* If(dsn is not explicitly passed in as arg) */
if (argc != 2)
{
    /* Use default dsn - odbc_demo */
    fprintf (stdout, "\nUsing default DSN : %s\n", defDsn);
    strcpy ((char *)dsn, (char *)defDsn);
}
else
{
    /* Use specified dsn */
    strcpy ((char *)dsn, (char *)argv[1]);
    fprintf (stdout, "\nUsing specified DSN : %s\n", dsn);
}

```

Creating a Smart Large Object

```
/* Allocate the Environment handle */
rc = SQLAllocHandle (SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv);
if (rc != SQL_SUCCESS)
{
    fprintf (stdout, "Environment Handle Allocation failed\nExiting!!");
    return (1);
}

/* Set the ODBC version to 3.0 */
rc = SQLSetEnvAttr (henv, SQL_ATTR_ODBC_VERSION, (SQLPOINTER)SQL_OV_ODBC3, 0);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- SQLSetEnvAttr
    failed\nExiting!!"))
    return (1);

/* Allocate the connection handle */
rc = SQLAllocHandle (SQL_HANDLE_DBC, henv, &hdbc);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- Connection Handle
    Allocation failed\nExiting!!"))
    return (1);

/* Establish the database connection */
rc = SQLConnect (hdbc, dsn, SQL_NTS, "", SQL_NTS, "", SQL_NTS);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- SQLConnect
    failed\n"))
    return (1);

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hstmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- Statement Handle
    Allocation failed\nExiting!!"))
    return (1);

fprintf (stdout, "STEP 1 done...connected to database\n");

/* STEP 2.  Get the size of the smart large object specification structure
**          Allocate a buffer to hold the structure
**          Create a default smart large object specification structure
**          Reset the statement parameters
*/

/* Get the size of a smart large object specification structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_SPEC_LENGTH, &lospec_size,
    sizeof(lospec_size), NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 2 -- SQLGetInfo
    failed\n"))
    goto Exit;
```



```
/* Allocate a buffer to hold the smart large object specification
   structure*/
lospec_buffer = malloc (lospec_size);

/* Create a default smart large object specification structure */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT_OUTPUT, SQL_C_BINARY,
                      SQL_INFX_UDT_FIXED, (UDWORD)lospec_size, 0,
                      lospec_buffer, lospec_size, &lospec_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_def_create_spec(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 2 done...default smart large object specification
structure created\n");

/* STEP 3.  Initialise the smart large object specification structure with
**          values for the database column where the smart large object is
**          being inserted
**          Reset the statement parameters
*/

/* Initialise the smart large object specification structure */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_CHAR, SQL_CHAR,
                      BUFFER_LEN, 0, colname, BUFFER_LEN, &colname_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

lospec_valsize = lospec_size;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT_OUTPUT, SQL_C_BINARY,
                      SQL_INFX_UDT_FIXED, (UDWORD)lospec_size, 0, lospec_buffer,
                      lospec_size, &lospec_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_col_info(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLExecDirect
failed\n"))
    goto Exit;
```

Creating a Smart Large Object

```
/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf(stdout, "STEP 3 done...smart large object specification structure
    initialised\n");

/* STEP 4.  Get the size of the smart large object pointer structure
**      Allocate a buffer to hold the structure.
*/

/* Get the size of the smart large object pointer structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_PTR_LENGTH, &loptr_size, sizeof(loptr_size),
    NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 4 -- SQLGetInfo
    failed\n"))
    goto Exit;

/* Allocate a buffer to hold the smart large object pointer structure */
loptr_buffer = malloc (loptr_size);

fprintf (stdout, "STEP 4 done...smart large object pointer structure
    allocated\n");

/* STEP 5.  Create a new smart large object.
**      Reset the statement parameters
*/

/* Create a new smart large object */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)lospec_size, 0, lospec_buffer,
    lospec_size, &lospec_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_SLONG, SQL_INTEGER,
    (UDWORD)0, 0, &mode, sizeof(mode), &cbMode);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
    failed (param 2)\n"))
    goto Exit;

loptr_valsize = loptr_size;

rc = SQLBindParameter (hstmt, 3, SQL_PARAM_INPUT_OUTPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)loptr_size, 0, loptr_buffer, loptr_size,
    &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
    failed (param 3)\n"))
    goto Exit;
```

```

rc = SQLBindParameter (hstmt, 4, SQL_PARAM_OUTPUT, SQL_C_SLONG, SQL_INTEGER,
                        (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
failed (param 4)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_create(?, ?, ?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 5 done...smart large object created\n");

/* STEP 6.  Open the file containing data for the new smart large object
**          Allocate a buffer to hold the smart large object data
**          Read data from the input file into the smart large object data buffer
**          Write data from the data buffer into the new smart large object.
**          Reset the statement parameters
*/

/* Open the file containing data for the new smart large object */
hfile = open (lo_file_name, "rt");
/* sneaky way to get the size of the file */
write_size = lseek (open (lo_file_name, "rt"), 0L, SEEK_END);

/* Allocate a buffer to hold the smart large object data */
write_buffer = malloc (write_size + 1);

/* Read smart large object data from file */
read (hfile, write_buffer, write_size);

write_buffer[write_size] = '\0';
write_valsize = write_size;

/* Write data from the data buffer into the new smart large object */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_SLONG, SQL_INTEGER,
                        (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR, SQL_CHAR,
                        (UDWORD)write_size, 0, write_buffer, write_size, &write_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

```

Creating a Smart Large Object

```
rc = SQLExecDirect (hstmt, "{call ifx_lo_write(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLExecDirect
    failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 6 done...data written to new smart large object\n");

/* STEP 7. Insert the new smart large object into the database.
**      Reset the statement parameters
*/

/* Insert the new smart large object into the database */
loptr_valsize = loptr_size;

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)loptr_size, 0, loptr_buffer, loptr_size,
    &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLBindParameter
    failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, insertStmt, SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLExecDirect
    failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 7 done...smart large object inserted into the
    database\n");

/* STEP 8. Close the smart large object.
*/

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG, SQL_INTEGER,
    (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLBindParameter
    failed\n"))
    goto Exit;
```

```
rc = SQLExecDirect (hstmt, "{call ifx_lo_close(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLExecDirect
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 8 done...smart large object closed\n");

/* STEP 9. Free the allocated buffers */

free (lospec_buffer);
free (loptr_buffer);
free (write_buffer);

fprintf (stdout, "STEP 9 done...smart large object buffers freed\n");

Exit:

/* CLEANUP: Close the statement handle
**      Free the statement handle
**      Disconnect from the datasource
**      Free the connection and environment handles
**      Exit
*/

/* Close the statement handle */
SQLFreeStmt (hstmt, SQL_CLOSE);

/* Free the statement handle */
SQLFreeHandle (SQL_HANDLE_STMT, hstmt);

/* Disconnect from the data source */
SQLDisconnect (hdbc);

/* Free the environment handle and the database connection handle */
SQLFreeHandle (SQL_HANDLE_DBC, hdbc);
SQLFreeHandle (SQL_HANDLE_ENV, henv);

fprintf (stdout, "\n\nHit <Enter> to terminate the program...\n\n");
in = getchar ();
return (rc);
}
```

Transferring Smart-Large-Object Data

An INSERT or UPDATE statement does not perform the actual input of the smart-large-object data. It does, however, provide a means for the application to identify which smart-large-object data to associate with the column. A BLOB or CLOB column in a database table stores the smart-large-object pointer structure for a smart large object. Therefore, when you store a BLOB or CLOB column, you provide a smart-large-object pointer structure for the column in a **loptr** variable to the INSERT or UPDATE statement.

Figure 5-2 shows how an application transfers the data of a smart large object to the database server.

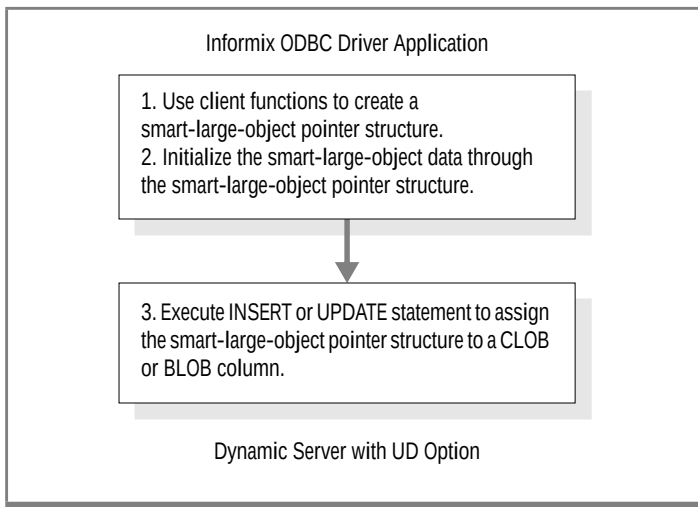


Figure 5-2
*Transferring
Smart-Large-
Object Data from
Client Application to
Database Server*

The smart large object that a smart-large-object pointer structure identifies exists as long as the smart-large-object pointer structure exists. When you store a smart-large-object pointer structure in a database, the database server deallocates the smart large object when appropriate.

If your application does not store the smart-large-object pointer structure for a new smart large object in the database, the smart-large-object pointer structure is only valid to access the version of the smart large object that was current when the pointer was passed to the application. If the smart large object is subsequently updated, the pointer is invalid. The smart-large-object pointer structures that you store in a row do not expire when the object version changes.

When you retrieve a row and then update a smart large object that is contained in that row, the database server exclusively locks the row for the time that it updates the smart large object. Moreover, long updates for smart large objects (whether or not logging is enabled and whether or not they are associated with a table row) create the potential for a long transaction condition if the smart large object takes a long time to update or create.

The smart-large-object pointer structure, not the CLOB or BLOB data itself, is stored in a CLOB or BLOB column in the database. Therefore, SQL statements such as INSERT and SELECT accept and return a smart-large-object pointer structure as the column value for a smart-large-object column.

Accessing a Smart Large Object

This section describes how to select, open, delete, modify, and close a smart large object. The section includes a code example at the end.

Selecting a Smart Large Object

A `SELECT` statement does not perform the actual output for the smart-large-object data. It does, however, establish a means for the application to identify a smart large object so that the application can then perform operations on the smart large object. [Figure 5-3 on page 5-22](#) shows how the database server transfers the data of a smart large object to the application.

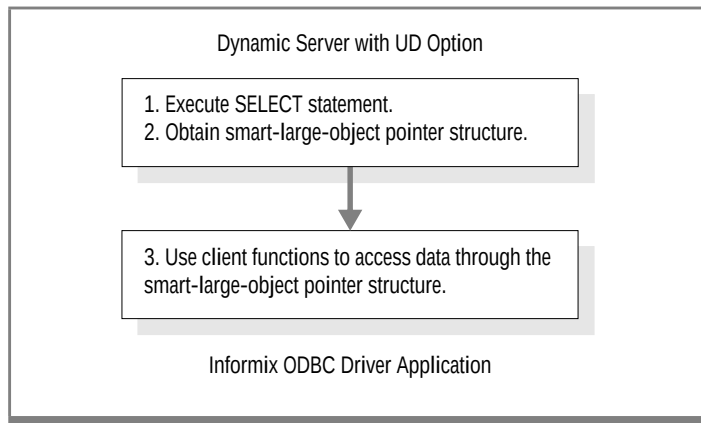


Figure 5-3
*Transferring
Smart-Large-
Object Data from
Database Server to
Client Application*

Opening a Smart Large Object

When you open a smart large object, you obtain a smart-large-object file descriptor for the smart large object. Through the smart-large-object file descriptor you can access the data of a smart large object as if it were in an operating-system file.

Access Modes

When you open a smart large object, you specify the access mode for the data. The access mode determines which read and write operations are valid on the open smart large object. The following table describes the access modes that **ifx_lo_open()** and **ifx_lo_create()** support.

Access Mode	Purpose	Constant
Read only	Only read operations are valid on the data.	LO_RDONLY
Dirty read	Lets you read uncommitted data pages for the smart large object. You cannot write to a smart large object after you set the mode to LO_DIRTY_READ. When you set this flag, you reset the current transaction isolation mode to dirty read for this smart large object. Do not base updates on data that you obtain from a smart large object in dirty-read mode.	LO_DIRTY_READ
Write only	Only write operations are valid on the data.	LO_WRONLY
Append	Intended for use in conjunction with LO_WRONLY or LO_RDWR. Sets the location pointer to the end of the object immediately prior to each write. Appends any data you write to the end of the smart large object. If LO_APPEND is used alone, the object is opened for reading only.	LO_APPEND
Read / write	Both read and write operations are valid on the data.	LO_RDWR
Buffered access	Uses standard database server buffer pool.	LO_BUFFER
Lightweight I/O	Uses private buffers from the session pool of the database server.	LO_NOBUFFER

When you open a smart large object with LO_APPEND only, the database server opens the smart large object as read-only. Seek operations and read operations move the file pointer. Write operations fail and do not move the file pointer.

You can mask the LO_APPEND flag with another access mode. In any of these OR combinations, the seek operation remains unaffected. The following table shows the effect on the read and write operations that each of the OR combinations has.

OR Operation	Read Operations	Write Operations
LO_RDONLY LO_APPEND	Occur at the file position and then move the file position to the end of the data that has been read.	Fail and do not move the file position.
LO_WRONLY LO_APPEND	Fail and do not move the file position.	Move the file position to the end of the smart large object and then write the data; file position is at the end of the data after the write.
LO_RDWR LO_APPEND	Occur at the file position and then move the file position to the end of the data that has been read.	Move the file position to the end of the smart large object and then write the data; file position is at the end of the data after the write.

Lightweight I/O

When the database server accesses smart large objects, it uses buffers from the buffer pool for buffered access. Unbuffered access is called *lightweight I/O*. Lightweight I/O uses private buffers instead of the buffer pool to hold smart large objects. These private buffers are allocated out of the database server session pool.

Lightweight I/O allows you to bypass the overhead of the least-recently-used (LRU) queues that the database server uses to manage the buffer pool. For more information about LRUs, see your [Performance Guide](#).

You can specify lightweight I/O by setting the flags parameter to LO_NOBUFFER when you create or open a smart large object. To specify buffered access, which is the default, use the LO_BUFFER flag.



Important: Keep the following issues in mind when you use lightweight I/O:

- Close smart large objects with **ifx_lo_close()** when you finish with them to free memory allocated to the private buffers.
- All open operations that use lightweight I/O for a particular smart large object share the same private buffers. Consequently, one operation can cause the pages in the buffer to be flushed while other operations expect the object to be present in the buffer.

The database server imposes the following restrictions on switching from lightweight I/O to buffered I/O:

- You can use the **ifx_lo_alter()** function to switch a smart large object from lightweight I/O (LO_NOBUFFER) to buffered I/O (LO_BUFFER) if the smart large object is *not* open. However, **ifx_lo_alter()** generates an error if you try to change a smart large object that uses buffered I/O to one that uses lightweight I/O.
- Unless you first use **ifx_lo_alter()** to change the access mode to buffered access (LO_BUFFER), you can only open a smart large object that was created with lightweight I/O with the LO_NOBUFFER access-mode flag. If an open operation specifies LO_BUFFER, the database server ignores the flag.
- You can open a smart large object that has been created with buffered access (LO_BUFFER) with the LO_NOBUFFER flag only if you open the object in read-only mode. If you attempt to write to the object, the database server returns an error. To write to the smart large object, you must close it and then reopen it with the LO_BUFFER flag and an access flag that allows write operations.

You can use the database server utility **onspaces** to specify lightweight I/O for all smart large objects in an sbspace. For more information on the **onspaces** utility, see your [Administrator's Guide](#).

Smart-Large-Object Locks

To prevent simultaneous access to smart-large-object data, the database server locks a smart large object when you open it. Locks on smart large objects are different than row locks. If you retrieve a smart large object from a row, the database server might hold a row lock as well as a smart-large-object lock. The database server locks smart large objects because many columns can contain the same smart-large-object data.

To specify the lock mode of a smart large object, pass the access-mode flags, LO_RDONLY, LO_DIRTY_READ, LO_APPEND, LO_WRONLY, LO_RDWR, and LO_TRUNC, to the **ifx_lo_open()** and **ifx_lo_create()** functions. When you specify LO_RDONLY, the database server places a lock on the smart-large-object data. When you specify LO_DIRTY_READ, the database server does not place a lock on the smart-large-object data. If you specify any other access-mode flag, the database server obtains an update lock, which it promotes to an exclusive lock on first write or other update operation.

Share and update locks (read-only mode or write mode before an update operation occurs) are held until your application takes one of the following actions:

- Closes the smart large object
- Commits the transaction or rolls it back

Exclusive locks are held until the end of a transaction even if you close the smart large object.



Important: You lose the lock at the end of a transaction even if the smart large object remains open. When the database server detects that a smart large object does not have an active lock, it places a new lock the next time that you access the smart large object. The lock that it places is based on the original open mode of the smart large object.

Duration of an Open Operation on a Smart Large Object

After you open a smart large object with the **ifx_lo_create()** function or the **ifx_lo_open()** function, it remains open until one of the following events occurs:

- The **ifx_lo_close()** function closes the smart large object.
- The session ends.



Warning: The end of the current transaction does not close a smart large object. It does, however, release any lock on a smart large object.

Close smart large objects as soon as you finish using them. Leaving smart large objects open unnecessarily consumes system memory. Leaving many smart large objects open can eventually produce an out-of-memory condition.

Deleting a Smart Large Object

A smart large object is not deleted until *both* of the following conditions are met:

- The current transaction commits.
- The smart large object is closed, if the application opened the smart large object.

Modifying a Smart Large Object

To modify the data of a smart large object, perform the following steps:

1. Read and write the data in the open smart large object.
2. Use an UPDATE or INSERT statement to store the smart-large-object pointer in the database.

Closing a Smart Large Object

After you finish modifying a smart large object, call **ifx_lo_close()** to deallocate the resources that are assigned to it. When the resources are freed, you can reallocate them to other structures that your application needs. You can also reallocate the smart-large-object file descriptor to other smart large objects.

Example of Retrieving a Smart Large Object from the Database

The following code example, **lselect.c**, shows how to retrieve a smart large object from the database. You can find the **lselect.c** file in the **%INFORMIXDIR%\demo\clidemo** directory on UNIX platforms and in the **%INFORMIXDIR%\demo\odbcdemo** directory on Windows platforms. You can also find instructions on how to build the **odbc_demo** database in the same location.

```
/*
**      lselect.c
**
**  To access a smart large object
**      SQLBindCol
**      SQLBindParameter
**      SQLConnect
**      SQLFetch
**      SQLFreeStmt
**      SQLGetInfo
**      SQLDisconnect
**      SQLExecDirect
*/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef NO_WIN32
#include <io.h>
#include <windows.h>
#include <conio.h>
#endif /*NO_WIN32*/

#include "infxccli.h"

#define ERRMSG_LEN 200

UCHAR  defDsn[] = "odbc_demo";

int checkError (SQLRETURN      rc,
                SQLSMALLINT    handleType,
                SQLHANDLE       handle,
                char            *errmsg)
{
    SQLRETURN      retcode = SQL_SUCCESS;
```

Example of Retrieving a Smart Large Object from the Database

```
SQLSMALLINT    errNum = 1;
SQLCHAR        sqlState[6];
SQLINTEGER     nativeError;
SQLCHAR        errMsg[ERRMSG_LEN];
SQLSMALLINT    textLengthPtr;

if ((rc != SQL_SUCCESS) && (rc != SQL_SUCCESS_WITH_INFO))
{
    while (retcode != SQL_NO_DATA)
    {
        retcode = SQLGetDiagRec (handleType, handle, errNum, sqlState,
                                &nativeError, errMsg, ERRMSG_LEN, &textLengthPtr);

        if (retcode == SQL_INVALID_HANDLE)
        {
            fprintf (stderr, "checkError function was called with an invalid
                          handle!!\n");
            return 1;
        }

        if ((retcode == SQL_SUCCESS) || (retcode == SQL_SUCCESS_WITH_INFO))
            fprintf (stderr, "ERROR: %d:  %s : %s \n", nativeError, sqlState,
                    errMsg);

        errNum++;
    }

    fprintf (stderr, "%s\n", errMsg);
    return 1;  /* all errors on this handle have been reported */
}
else
    return 0;  /* no errors to report */
}

int main (long        argc,
          char        *argv[])
{
    /* Declare variables
    */

    /* Handles */
    SQLHDBC    hdbc;
    SQLHENV    henv;
    SQLHSTMT    hstmt;

    /* Smart large object file descriptor */
    long        lofd;
    long        lofd_valsize = 0;
}
```

Example of Retrieving a Smart Large Object from the Database

```
/* Smart large object pointer structure */
char*      loptr_buffer;
short      loptr_size;
long       loptr_valsize = 0;

/* Smart large object status structure */
char*      lostat_buffer;
short      lostat_size;
long       lostat_valsize = 0;

/* Smart large object data */
char*      lo_data;
long       lo_data_valsize = 0;

/* Miscellaneous variables */
UCHAR      dsn[20]; /*name of the DSN used for connecting to the database*/
SQLRETURN  rc = 0;
int        in;

char*      selectStmt = "SELECT advert FROM item WHERE item_num = 1004";
long       mode = LO_RDONLY;
long       lo_size;
long       cbMode = 0, cbLoSize = 0;

/* STEP 1. Get data source name from command line (or use default)
**      Allocate the environment handle and set ODBC version
**      Allocate the connection handle
**      Establish the database connection
**      Allocate the statement handle
*/

/* If(dsn is not explicitly passed in as arg) */
if (argc != 2)
{
    /* Use default dsn - odbc_demo */
    fprintf (stdout, "\nUsing default DSN : %s\n", defDsn);
    strcpy ((char *)dsn, (char *)defDsn);
}
else
{
    /* Use specified dsn */
    strcpy ((char *)dsn, (char *)argv[1]);
    fprintf (stdout, "\nUsing specified DSN : %s\n", dsn);
}

/* Allocate the Environment handle */
rc = SQLAllocHandle (SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv);
if (rc != SQL_SUCCESS)
{

```


Example of Retrieving a Smart Large Object from the Database

```
        fprintf (stdout, "Environment Handle Allocation failed\nExiting!!\n");
        return (1);
    }

    /* Set the ODBC version to 3.0 */
    rc = SQLSetEnvAttr (henv, SQL_ATTR_ODBC_VERSION, (SQLPOINTER)SQL_OV_ODBC3, 0);
    if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- SQLSetEnvAttr
        failed\nExiting!!\n"))
        return (1);

    /* Allocate the connection handle */
    rc = SQLAllocHandle (SQL_HANDLE_DBC, henv, &hdbc);
    if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- Connection Handle
        Allocation failed\nExiting!!\n"))
        return (1);

    /* Establish the database connection */
    rc = SQLConnect (hdbc, dsn, SQL_NTS, "", SQL_NTS, "", SQL_NTS);
    if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- SQLConnect
        failed\nExiting!!"))
        return (1);

    /* Allocate the statement handle */
    rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hstmt );
    if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- Statement Handle
        Allocation failed\nExiting!!"))
        return (1);

    fprintf (stdout, "STEP 1 done...connected to database\n");

    /* STEP 2.  Select a smart-large object from the database
    **          -- the select statement executed is -
    **          "SELECT advert FROM item WHERE item_num = 1004"
    */

    /* Execute the select statement */
    rc = SQLExecDirect (hstmt, selectStmt, SQL_NTS);
    if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
        failed\n"))
        goto Exit;

    fprintf (stdout, "STEP 2 done...select statement executed...smart large object
        retrieved from the databse\n");
```

Example of Retrieving a Smart Large Object from the Database

```
/* STEP 3.  Get the size of the smart large object pointer structure
**          Allocate a buffer to hold the structure.
**          Get the smart large object pointer structure from the database
**          Close the result set cursor
*/

/* Get the size of the smart large object pointer structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_PTR_LENGTH, &loptr_size, sizeof(loptr_size),
                NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 3 -- SQLGetInfo
                failed\n"))
    goto Exit;

/* Allocate a buffer to hold the smart large object pointer structure */
loptr_buffer = malloc (loptr_size);

/* Bind the smart large object pointer structure buffer allocated to the column
   in the result set & fetch it from the database */
rc = SQLBindCol (hstmt, 1, SQL_C_BINARY, loptr_buffer, loptr_size,
                &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindCol
                failed\n"))
    goto Exit;

rc = SQLFetch (hstmt);
if (rc == SQL_NO_DATA_FOUND)
{
    fprintf (stdout, "No Data Found\nExiting!!\n");
    goto Exit;
}
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLFetch
                failed\n"))
    goto Exit;

/* Close the result set cursor */
rc = SQLCloseCursor (hstmt);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLCloseCursor
                failed\n"))
    goto Exit;

fprintf (stdout, "STEP 3 done...smart large object pointer structure fetched
        from the database\n");

/* STEP 4.  Use the smart large object's pointer structure to open it
**          and obtain the smart large object file descriptor.
**          Reset the statement parameters
*/
```

Example of Retrieving a Smart Large Object from the Database

```
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_LONG,
                        SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
                        SQL_INFX_UDT_FIXED, (UDWORD)loptr_size, 0, loptr_buffer,
                        loptr_size, &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 3, SQL_PARAM_INPUT, SQL_C_LONG,
                        SQL_INTEGER, (UDWORD)0, 0, &mode, sizeof(mode), &cbMode);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
failed (param 3)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{? = call ifx_lo_open(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 4 done...smart large object opened... file descriptor
obtained\n");

/* STEP 5.  Get the size of the smart large object status structure
**          Allocate a buffer to hold the structure.
**          Get the smart large object status structure from the database
**          Reset the statement parameters
*/

/* Get the size of the smart large object status structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_STAT_LENGTH, &lostat_size,
                sizeof(lostat_size), NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 5 -- SQLGetInfo
failed\n"))
    goto Exit;

/* Allocate a buffer to hold the smart large object status structure. */
lostat_buffer = malloc(lostat_size);
```

Example of Retrieving a Smart Large Object from the Database

```
/* Get the smart large object status structure from the database. */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG,
                        SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT_OUTPUT,
                        SQL_C_BINARY, SQL_INFX_UDT_FIXED, (UDWORD)lost_size, 0,
                        lostat_buffer, lostat_size, &lostat_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_stat(?, ?)}",
                    SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 5 done...smart large object status structure fetched
from the database\n");

/* STEP 6. Use the smart large object's status structure to get the size
**      of the smart large object
**      Reset the statement parameters
*/

/* Use the smart large object status structure to get the size
of the smart large object. */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
                        SQL_INFX_UDT_FIXED, (UDWORD)lost_size, 0, lostat_buffer,
                        lostat_size, &lostat_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_OUTPUT, SQL_C_LONG,
                        SQL_BIGINT, (UDWORD)0, 0, &lo_size, sizeof(lo_size), &cbLoSize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;
```

Example of Retrieving a Smart Large Object from the Database

```
rc = SQLExecDirect (hstmt, "{call ifx_lo_stat_size(?, ?)}",
                    SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 6 done...smart large object size = %ld bytes\n",
        lo_size);

/* STEP 7.  Allocate a buffer to hold the smart large object's data
**          Read the smart large object's data using its file descriptor
**          Null-terminate the last byte of the smart large-object's data
**          Print out the contents of the smart large object
**          Reset the statement parameters
*/

/* Allocate a buffer to hold the smart large object's data chunks */
lo_data = malloc (lo_size + 1);

/* Read the smart large object's data */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG,
                        SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_OUTPUT, SQL_C_CHAR,
                        SQL_CHAR, lo_size, 0, lo_data, lo_size, &lo_data_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_read(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Null-terminate the last byte of the smart large objects data */
lo_data[lo_size] = '\0';

/* Print the contents of the smart large object */
fprintf (stdout, "Smart large object contents are.....\n\n%s\n\n",
        lo_data);
```

Example of Retrieving a Smart Large Object from the Database

```
/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 7 done...smart large object read completely\n");

/* STEP 8. Close the smart large object.
*/

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG,
    SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLBindParameter
    failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_close(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLExecDirect
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 8 done...smart large object closed\n");

/* STEP 9. Free the allocated buffers */

free (loptr_buffer);
free (lostat_buffer);
free (lo_data);

fprintf (stdout, "STEP 9 done...smart large object buffers freed\n");

Exit:

/* CLEANUP: Close the statement handle
**      Free the statement handle
**      Disconnect from the datasource
**      Free the connection and environment handles
**      Exit
*/

/* Close the statement handle */
SQLFreeStmt (hstmt, SQL_CLOSE);

/* Free the statement handle */
SQLFreeHandle (SQL_HANDLE_STMT, hstmt);

/* Disconnect from the data source */
SQLDisconnect (hdbc);
```

```
/* Free the environment handle and the database connection handle */
SQLFreeHandle (SQL_HANDLE_DBC, hdbc);
SQLFreeHandle (SQL_HANDLE_ENV, henv);

fprintf (stdout, "\n\nHit <Enter> to terminate the program...\n\n");
in = getchar ();
return (rc);
}
```

Retrieving the Status of a Smart Large Object

The following table describes the status information and the corresponding client functions.

Disk-Storage Information	Description	Client Functions
Last access time	The time, in seconds, that a smart large object was last accessed. This value is available only if the LO_KEEP_LASTACCESS_TIME flag is set for the smart large object.	ifx_lo_stat_atime()
Last change in status	The time, in seconds, of the last status change for a smart large object. A change in status includes updates, changes in ownership, and changes to the number of references.	ifx_lo_stat_ctime()
Last modification time (seconds)	The time, in seconds, that a smart large object was last modified.	ifx_lo_stat_mtime_sec()
Last modification time (microseconds)	The microsecond component of the time of last modification. This value is only supported on platforms that provide system time to microsecond granularity.	ifx_lo_stat_mtime_usec()
Reference count	A count of the number of references to a smart large object.	ifx_lo_stat_refcnt()
Size	The size, in bytes, of a smart large object.	ifx_lo_stat_size()

The time values (such as last access time and last change time) might differ slightly from the system time. This difference is due to the algorithm that the database server uses to obtain the time from the operating system.

Example of Retrieving Information About a Smart Large Object

The following code example, **loinfo.c**, shows how to retrieve information about a smart large object. You can find the **loinfo.c** file in the **%INFORMIXDIR%\demo\clidemo** directory on UNIX platforms and in the **%INFORMIXDIR%\demo\odbcdemo** directory in Windows environments. You can also find instructions on how to build the **odbc_demo** database in the same location.

```
/*
**      loinfo.c
**
**      To check the status of a smart large object
**
**      ODBC Functions:
**      SQLBindCol
**      SQLBindParameter
**      SQLConnect
**      SQLFetch
**      SQLFreeStmt
**      SQLDisconnect
**      SQLExecDirect
**/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef NO_WIN32
#include <io.h>
#include <windows.h>
#include <conio.h>
#endif /*NO_WIN32*/

#include "infxcli.h"

#define BUFFER_LEN  20
#define ERRMSG_LEN  200

UCHAR  defDsn[] = "odbc_demo";
```


Example of Retrieving Information About a Smart Large Object

```
int checkError (SQLRETURN      rc,
                SQLSMALLINT    handleType,
                SQLHANDLE       handle,
                char             *errmsg)
{
    SQLRETURN      retcode = SQL_SUCCESS;

    SQLSMALLINT     errNum = 1;
    SQLCHAR         sqlState[6];
    SQLINTEGER      nativeError;
    SQLCHAR         errMsg[ERRMSG_LEN];
    SQLSMALLINT     textLengthPtr;

    if ((rc != SQL_SUCCESS) && (rc != SQL_SUCCESS_WITH_INFO))
    {
        while (retcode != SQL_NO_DATA)
        {
            retcode = SQLGetDiagRec (handleType, handle, errNum, sqlState,
                                     &nativeError, errMsg, ERRMSG_LEN, &textLengthPtr);

            if (retcode == SQL_INVALID_HANDLE)
            {
                fprintf (stderr, "checkError function was called with an invalid
                                handle!!\n");
                return 1;
            }

            if ((retcode == SQL_SUCCESS) || (retcode == SQL_SUCCESS_WITH_INFO))
                fprintf (stderr, "ERROR: %d:  %s : %s \n", nativeError, sqlState,
                        errMsg);

            errNum++;
        }

        fprintf (stderr, "%s\n", errMsg);
        return 1;  /* all errors on this handle have been reported */
    }
    else
        return 0;  /* no errors to report */
}

int main (long      argc,
          char       *argv[])
{
    /* Declare variables
    */

    /* Handles */
    SQLHDBC      hdbc;
    SQLHENV      henv;
    SQLHSTMT     hstmt;
```

Example of Retrieving Information About a Smart Large Object

```
/* Smart large object file descriptor */
long      lofd;
long      lofd_valsize = 0;

/* Smart large object specification structure */
char*      lospec_buffer;
short      lospec_size;
long      lospec_valsize = 0;

/* Smart large object status structure */
char*      lostat_buffer;
short      lostat_size;
long      lostat_valsize = 0;

/* Smart large object pointer structure */
char*      loptr_buffer;
short      loptr_size;
long      loptr_valsize = 0;

/* Miscellaneous variables */
UCHAR      dsn[20]; /*name of the DSN used for connecting to the database*/
SQLRETURN  rc = 0;
int         in;

char*      selectStmt = "SELECT advert FROM item WHERE item_num = 1004";
long       lo_size;
long       mode = LO_RDONLY;

char        sbpace_name[BUFFER_LEN];
long       sbpace_name_size = SQL_NTS;

long       cbMode = 0, cbLoSize = 0;

/* STEP 1. Get data source name from command line (or use default)
**      Allocate the environment handle and set ODBC version
**      Allocate the connection handle
**      Establish the database connection
**      Allocate the statement handle
*/

/* If(dsn is not explicitly passed in as arg) */
if (argc != 2)
{
    /* Use default dsn - odbc_demo */
    fprintf (stdout, "\nUsing default DSN : %s\n", defDsn);
    strcpy ((char *)dsn, (char *)defDsn);
}
else
```

Example of Retrieving Information About a Smart Large Object

```
{
    /* Use specified dsn */
    strcpy ((char *)dsn, (char *)argv[1]);
    fprintf (stdout, "\nUsing specified DSN : %s\n", dsn);
}

/* Allocate the Environment handle */
rc = SQLAllocHandle (SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv);
if (rc != SQL_SUCCESS)
{
    fprintf (stdout, "Environment Handle Allocation failed\nExiting!!\n");
    return (1);
}

/* Set the ODBC version to 3.0 */
rc = SQLSetEnvAttr (henv, SQL_ATTR_ODBC_VERSION, (SQLPOINTER)SQL_OV_ODBC3, 0);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- SQLSetEnvAttr
    failed\nExiting!!\n"))
    return (1);

/* Allocate the connection handle */
rc = SQLAllocHandle (SQL_HANDLE_DBC, henv, &hdbc);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- Connection Handle
    Allocation failed\nExiting!!\n"))
    return (1);

/* Establish the database connection */
rc = SQLConnect (hdbc, dsn, SQL_NTS, "", SQL_NTS, "", SQL_NTS);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- SQLConnect
    failed\nExiting!!\n"))
    return (1);

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hstmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- Statement Handle
    Allocation failed\nExiting!!\n"))
    return (1);

fprintf (stdout, "STEP 1 done...connected to database\n");

/* STEP 2.  Select a smart-large object from the database
**          -- the select statement executed is -
**          "SELECT advert FROM item WHERE item_num = 1004"
**          */
```

Example of Retrieving Information About a Smart Large Object

```
/* Execute the select statement */
rc = SQLExecDirect (hstmt, selectStmt, SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 2 done...select statement executed...smart large object
    retrieved from the databse\n");

/* STEP 3.  Get the size of the smart large object pointer structure
**      Allocate a buffer to hold the structure.
**      Get the smart large object pointer structure from the database
**      Close the result set cursor
*/

/* Get the size of the smart large object pointer structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_PTR_LENGTH, &loptr_size, sizeof(loptr_size),
    NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 3 -- SQLGetInfo
    failed\n"))
    goto Exit;

/* Allocate a buffer to hold the smart large object pointer structure */
loptr_buffer = malloc (loptr_size);

/* Bind the smart large object pointer structure buffer allocated to the column
    in the result set & fetch it from the database */
rc = SQLBindCol (hstmt, 1, SQL_C_BINARY, loptr_buffer, loptr_size,
    &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindCol
    failed\n"))
    goto Exit;

rc = SQLFetch (hstmt);
if (rc == SQL_NO_DATA_FOUND)
{
    fprintf (stdout, "No Data Found\nExiting!!\n");
    goto Exit;
}
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLFetch
    failed\n"))
    goto Exit;

/* Close the result set cursor */
rc = SQLCloseCursor (hstmt);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLCloseCursor
    failed\n"))
    goto Exit;
```

Example of Retrieving Information About a Smart Large Object

```
fprintf (stdout, "STEP 3 done...smart large object pointer structure fetched
        from the database\n");
/* STEP 4.  Use the smart large object's pointer structure to open it and obtain
        the smart large
        object file descriptor.
        **
        **      Reset the statement parameters
        */

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_LONG,
        SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
        failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
        SQL_INFX_UDT_FIXED, (UDWORD)loptr_size, 0, loptr_buffer,
        loptr_size, &loptr_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
        failed (param 2)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 3, SQL_PARAM_INPUT, SQL_C_LONG,
        SQL_INTEGER, (UDWORD)0, 0, &mode, sizeof(mode), &cbMode);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
        failed (param 3)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{? = call ifx_lo_open(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLExecDirect
        failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLFreeStmt
        failed\n"))
    goto Exit;

fprintf (stdout, "STEP 4 done...smart large object opened... file descriptor
        obtained\n");

/* STEP 5.  Get the size of the smart large object status structure
**      Allocate a buffer to hold the structure.
**      Get the smart large object status structure from the database
**      Reset the statement parameters
**
*/

/* Get the size of the smart large object status structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_STAT_LENGTH, &lostat_size,
        sizeof(lostat_size), NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 5 -- SQLGetInfo
        failed\n"))
    goto Exit;
```

Example of Retrieving Information About a Smart Large Object

```
/* Allocate a buffer to hold the smart large object status structure. */
lostat_buffer = malloc(lostat_size);

/* Get the smart large object status structure from the database. */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG,
                        SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT_OUTPUT,
                        SQL_C_BINARY, SQL_INFX_UDT_FIXED, (UDWORD)lostat_size, 0,
                        lostat_buffer, lostat_size, &lostat_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLBindParameter
failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_stat(?, ?)}",
                    SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 5 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 5 done...smart large object status structure fetched
from the database\n");

/* STEP 6. Use the smart large object's status structure to get the size
** of the smart large object
** Reset the statement parameters
**
** You can use additional ifx_lo_stat_*( ) functions to get more
** status information about the smart large object.
**
** You can also use it to retrieve the smart large object specification
** structure and get further information about the smart large object
** using it's specification structure.
**
*/

/* Use the smart large object status structure to get the size
of the smart large object. */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
                        SQL_INFX_UDT_FIXED, (UDWORD)lostat_size, 0, lostat_buffer,
                        lostat_size, &lostat_valsize);
```

Example of Retrieving Information About a Smart Large Object

```
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_OUTPUT, SQL_C_LONG,
    SQL_BIGINT, (UDWORD)0, 0, &lo_size, sizeof(lo_size), &cbloSize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_stat_size(?, ?)}",
    SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLExecDirect
    failed\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 6 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "LARGE OBJECT SIZE = %ld\n", lo_size);
fprintf (stdout, "STEP 6 done...smart large object size retrieved\n");

/* STEP 7.  Get the size of the smart large object specification structure
**      Allocate a buffer to hold the structure.
**      Get the smart large object specification structure from the database
**      Reset the statement parameters
**/

/* Get the size of the smart large object specification structure */
rc = SQLGetInfo (hdbc, SQL_INFX_LO_SPEC_LENGTH, &lospec_size,
    sizeof(lospec_size), NULL);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 7 -- SQLGetInfo
    failed\n"))
    goto Exit;

/* Allocate a buffer to hold the smart large object specification structure. */
lospec_buffer = malloc (lospec_size);

/* Get the smart large object specification structure from the database */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)lostat_size, 0, lostat_buffer,
    lostat_size, &lostat_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_OUTPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)lospec_size, 0, lospec_buffer,
    lospec_size, &lospec_valsize);
```

Example of Retrieving Information About a Smart Large Object

```
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLBindParameter
    failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_stat_cspec(?, ?)}",
    SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 7 -- SQLExecDirect
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 7 done...smart large object status structure fetched
    from the database\n");

/* STEP 8. Use the smart large object's specification structure to get the
    sbospace
    ** name where the smart large object is stored
    ** Reset the statement parameters
    */

/* Use the smart large object's specification structure to get
    the sbospace name of the smart large object. */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_UDT_FIXED, (UDWORD)lospec_size, 0, lospec_buffer,
    lospec_size, &lospec_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_OUTPUT, SQL_C_CHAR,
    SQL_CHAR, BUFFER_LEN, 0, sbospace_name, BUFFER_LEN,
    &sbospace_name_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLBindParameter
    failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_specget_sbospace(?, ?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 8 -- SQLExecDirect
    failed\n"))
    goto Exit;

fprintf (stdout, "LARGE OBJECT SBOSPACE NAME = %s\n", sbospace_name);
fprintf (stdout, "STEP 8 done...large object sbospace name retrieved\n");

/* STEP 9. Close the smart large object.
    */
```


Example of Retrieving Information About a Smart Large Object

```
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_LONG,
                      SQL_INTEGER, (UDWORD)0, 0, &lofd, sizeof(lofd), &lofd_valsize);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 9 -- SQLBindParameter
failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{call ifx_lo_close(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 9 -- SQLExecDirect
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 9 done...smart large object closed\n");

/* STEP 10. Free the allocated buffers */

free (loptr_buffer);
free (lostat_buffer);
free (lospec_buffer);

fprintf (stdout, "STEP 10 done...smart large object buffers freed\n");

Exit:

/* CLEANUP: Close the statement handle
**      Free the statement handle
**      Disconnect from the datasource
**      Free the connection and environment handles
**      Exit
*/

/* Close the statement handle */
SQLFreeStmt (hstmt, SQL_CLOSE);

/* Free the statement handle */
SQLFreeHandle (SQL_HANDLE_STMT, hstmt);

/* Disconnect from the data source */
SQLDisconnect (hdbc);

/* Free the environment handle and the database connection handle */
SQLFreeHandle (SQL_HANDLE_DBC, hdbc);
SQLFreeHandle (SQL_HANDLE_ENV, henv);

fprintf (stdout, "\n\nHit <Enter> to terminate the program...\n\n");
in = getchar ();
return (rc);
}
```

Reading or Writing a Smart Large Object to or from a File

You can use the SQL functions **FILETOBLOB()** and **FILETOCLOB()** to transfer data from a file to a smart large object. The file can be on a client computer or on a server computer.

You can use the SQL function **LOTOFILE()** to transfer data from a smart large object to a file. The file may be on a client computer or on a server computer. **LOTOFILE()** accepts a smart-large-object pointer as a parameter. You can use the smart-large-object pointer structure for this parameter.

For more information about these SQL functions, see the [Informix Guide to SQL: Syntax](#).

Working with Rows and Collections

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In This Chapter

The information in this chapter applies only if your database server is Informix Dynamic Server with Universal Data Option.

Rows and collections are composite values that consist of one or more elements. You can use the SELECT, UPDATE, INSERT, and DELETE statements to access an entire row or collection. However, these SQL statements do not let you access an element that is in a row or collection. To access an element, you need to retrieve the row or collection and then access the element from the local copy of the row or collection.

For more information about rows and collections, see [Chapter 4, “Data Types,”](#) the *Informix Guide to SQL: Reference*, and *Extending Informix Dynamic Server*. For information about the client functions that you use to access rows and collections, see [Chapter 7, “Client Functions.”](#)

Transferring Row and Collection Data

When you retrieve a row or collection, the database server puts the row or collection into a buffer that is local to your Informix ODBC Driver application.

To allocate and bind a row or collection buffer

1. Call **ifx_rc_create()** to allocate the buffer.
2. Execute a SELECT statement to transfer the row or collection data to the local buffer.
3. Call **SQLBindCol()** to bind the buffer handle to the database column.
4. Use the row or collection buffer.
5. Call **ifx_rc_free()** to deallocate the buffer.

Fixed-Type Buffers and Unfixed-Type Buffers

The following table describes the differences between fixed-type buffers and unfixed-type buffers.

Kind of Buffer	Description
Fixed type	When you call ifx_rc_create() to create a row or collection buffer, you specify the following data types for the buffer: ■ The buffer data type (a row or one of the collection types) ■ The data types of the elements that are in the row or collection When you retrieve the row or collection, the database server compares the source and target data types and converts data from one Informix SQL data type to another as necessary. You can modify the row or collection buffer before you retrieve data into the buffer.
Unfixed type	When you call ifx_rc_create() to create a row or collection buffer, you specify only the buffer data type (a row or a collection) and <i>not</i> the element types. When you retrieve the row or collection, the database server does not compare data types because you did not specify the target data types. Instead, the row or collection buffer adopts the data types of the source data. You must initialize the row or collection buffer before you modify it. To initialize the buffer, retrieve a row or collection into it. The buffer type remains unfixed even when it contains data.

Buffers and Memory Allocation

When you retrieve data into a buffer that already contains a row or collection, Informix ODBC Driver does not reuse the same buffer. Instead, Informix ODBC Driver performs the following steps:

1. Creates a new row or collection buffer
2. Associates the new buffer with the given buffer handle
3. Deallocates the original buffer

SQL Data

If the data types for a row or collection that are on a database server differ from the data types for a row or collection buffer into which the data is retrieved, the database server calls cast functions to convert the data from the source Informix SQL data types to the target Informix SQL data types. The following table lists the provider of the cast functions for each combination of source data type and target data type. Cast functions that a data type provides are located on the database server.

Source Data Type	Target Data Type	Provider of Cast Functions
Built-in	Built-in	Database server
Built-in	Extended	Data type
Extended	Built-in	Data type
Extended	Extended	Data type

Local Fetch

Informix ODBC Driver performs a local fetch when you retrieve a row or collection from one location on the client computer to another location on the client computer.

To perform a local fetch

1. Call **ifx_rc_create()** to allocate a row or collection buffer.
2. Execute a SELECT statement to transfer the row or collection data to the local buffer.
3. Call **SQLBindCol()** to bind the buffer handle to the local row or collection.
4. For each element in the row or collection, call **ifx_rc_fetch()** to copy the value to the buffer.
5. Use the row or collection buffer.
6. Call **ifx_rc_free()** to deallocate the buffer.

A local fetch has the following limits on SQL data conversion:

- Informix ODBC Driver cannot convert extended data types for which the cast functions are on a database server.
- Informix ODBC Driver cannot convert data from one named row type to another. Only Dynamic Server with UD Option can perform this kind of conversion.
- Informix ODBC Driver cannot convert SQL data types when retrieving an entire row or collection. Thus, Informix ODBC Driver can perform a local fetch of an entire row or collection only if the internal structures for the source and destination are the same or if the destination is an unfixed-type buffer.

For example, if you define a local collection as **list (char(1) not null)**, Dynamic Server with UD Option can put a **list (int not null)** value from the database server into the local collection. During this operation, the database server converts each integer into a string and constructs a new list to return to the client computer. You cannot perform this operation on the client computer where you retrieve a local list of integers into a list characters.

Example of Retrieving Row and Collection Data from the Database

The following sample program, **rcselect.c**, retrieves row and collection data from the database and displays it. This example also illustrates the fact that the same client functions can use row and collection handles interchangeably.

You can find the **rcselect.c** file in the **%INFORMIXDIR%\demo\clidemo** directory on UNIX platforms and in the **%INFORMIXDIR%\demo\odbcdemo** directory in Windows environments. You can also find instructions on how to build the **odbc_demo** database in the same location.

Example of Retrieving Row and Collection Data from the Database

```
/*
**      rcselect.c
**
**  To access rows and collections
**  ODBC Functions:
**      SQLBindParameter
**      SQLConnect
**      SQLDisconnect
**      SQLExecDirect
**      SQLFetch
**      SQLFreeStmt
**/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef NO_WIN32
#include <io.h>
#include <windows.h>
#include <conio.h>
#endif /*NO_WIN32*/

#include "infxccli.h"

#define BUFFER_LEN      25
#define ERRMSG_LEN      200

UCHAR    defDsn[] = "odbc_demo";

int checkError (SQLRETURN      rc,
                SQLSMALLINT    handleType,
                SQLHANDLE      handle,
                char            *errmsg)
{
    SQLRETURN      retcode = SQL_SUCCESS;

    SQLSMALLINT    errNum = 1;
    SQLCHAR        sqlState[6];
    SQLINTEGER     nativeError;
    SQLCHAR        errMsg[ERRMSG_LEN];
    SQLSMALLINT    textLengthPtr;

    if ((rc != SQL_SUCCESS) && (rc != SQL_SUCCESS_WITH_INFO))
    {
        while (retcode != SQL_NO_DATA)
        {
            retcode = SQLGetDiagRec (handleType, handle, errNum, sqlState,
                                     &nativeError, errMsg, ERRMSG_LEN, &textLengthPtr);

            if (retcode == SQL_INVALID_HANDLE)
            {

```

Example of Retrieving Row and Collection Data from the Database

```
        fprintf(stderr, "checkError function was called with an invalid
        handle!!\n");
        return 1;
    }

    if ((retcode == SQL_SUCCESS) || (retcode == SQL_SUCCESS_WITH_INFO))
        fprintf(stderr, "ERROR: %d:  %s : %s \n", nativeError, sqlState,
        errMsg);

    errNum++;
}

fprintf(stderr, "%s\n", errMsg);
return 1;  /* all errors on this handle have been reported */
}
else
    return 0;  /* no errors to report */
}

/*
** Executes the given select statement and assumes the results will be
** either rows or collections. The 'hrc' parameter may reference either
** a row or a collection. Rows and collection handles may often be used
** interchangeably.
**
** Each row of the select statement will be fetched into the given row or
** collection handle. Then each field of the row or collection will be
** individually converted into a character buffer and displayed.
**
** This function returns 0 if an error occurs, else returns 1
**
*/
int do_select (SQLHDBC      hdbc,
               char*       select_str,
               HINFX_RC    hrc)
{
    SQLHSTMT    hRCStmt;
    SQLHSTMT    hSelectStmt;
    SQLRETURN    rc = 0;

    short        index, rownum;
    short        position = SQL_INFX_RC_ABSOLUTE;
    short        jump;

    char         fname[BUFFER_LEN];
    char         lname[BUFFER_LEN];
    char         rc_data[BUFFER_LEN];

    SQLINTEGER    cbFname = 0, cbLname = 0, cbHrc = 0;
    SQLINTEGER    cbPosition = 0, cbJump = 0, cbRCData = 0;
```

Example of Retrieving Row and Collection Data from the Database

```
/* STEP A. Allocate the statement handles for the select statement and
**      the statement used to retrieve the row/collection data
*/

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hRCStmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step A -- Statement Handle
      Allocation failed for row/collection statement\nExiting!!"))
    return 0;

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hSelectStmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step A -- Statement Handle
      Allocation failed for select statement\nExiting!!"))
    return 0;

fprintf (stdout, "STEP A done...statement handles allocated\n");

/* STEP B. Execut the select statement
**      Bind the result set columns -
**      -- col1 = fname
**      col2 = lname
**      col3 = row/collection data
*/

/* Execute the select statement */
rc = SQLExecDirect (hSelectStmt, select_str, SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hSelectStmt, "Error in Step B --
      SQLExecDirect failed\n"))
    return 0;

/* Bind the result set columns */
rc = SQLBindCol (hSelectStmt, 1, SQL_C_CHAR, (SQLPOINTER)fname, BUFFER_LEN,
      &cbFname);
if (checkError (rc, SQL_HANDLE_STMT, hSelectStmt, "Error in Step B -- SQLBindCol
      failed for column 'fname'\n"))
    return 0;

rc = SQLBindCol (hSelectStmt, 2, SQL_C_CHAR, (SQLPOINTER)lname, BUFFER_LEN,
      &cbLname);
if (checkError (rc, SQL_HANDLE_STMT, hSelectStmt, "Error in Step B -- SQLBindCol
      failed for column 'lname'\n"))
    return 0;

rc = SQLBindCol (hSelectStmt, 3, SQL_C_BINARY, (SQLPOINTER)hrc,
      sizeof(HINFX_RC), &cbHrc);
if (checkError (rc, SQL_HANDLE_STMT, hSelectStmt, "Error in Step B -- SQLBindCol
      failed for row/collection column\n"))
    return 0;
```

Example of Retrieving Row and Collection Data from the Database

```
fprintf (stdout, "STEP B done...select statement executed and result set columns
bound\n");

/* STEP C. Retrieve the results
*/

for (rownum = 1;; rownum++)
{
    rc = SQLFetch (hSelectStmt);
    if (rc == SQL_NO_DATA_FOUND)
    {
        fprintf (stdout, "No data found...\n");
        break;
    }
    else if (checkError (rc, SQL_HANDLE_STMT, hSelectStmt, "Error in Step C --
        SQLFetch failed\n"))
        return 0;

    fprintf(stdout, "Retrieving row number %d:\n\tfname -- %s\n\tlname --
        %s\n\tRow/Collection Data --\n", rownum, fname, lname);

    /* For each row in the result set, display each field of the
       retrieved row/collection */
    for (index = 1;; index++)
    {
        strcpy(rc_data, "<null>");

        /* Each value in the local row/collection will be fetched into a
         * character buffer and displayed using fprintf().
         */
        rc = SQLBindParameter (hRCStmt, 1, SQL_PARAM_OUTPUT, SQL_C_CHAR,
            SQL_CHAR, 0, 0, rc_data, BUFFER_LEN, &cbRCData);
        if (checkError (rc, SQL_HANDLE_STMT, hRCStmt, "Error in Step C --
            SQLBindParameter failed (param 1)\n"))
            return 0;

        rc = SQLBindParameter (hRCStmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
            SQL_INFX_RC_COLLECTION, sizeof(HINFX_RC), 0, hrc,
            sizeof(HINFX_RC), &cbHrc);
        if (checkError (rc, SQL_HANDLE_STMT, hRCStmt, "Error in Step C --
            SQLBindParameter failed (param 2)\n"))
            return 0;

        rc = SQLBindParameter (hRCStmt, 3, SQL_PARAM_INPUT, SQL_C_SHORT,
            SQL_SMALLINT, 0, 0, &position, 0, &cbPosition);
        if (checkError (rc, SQL_HANDLE_STMT, hRCStmt, "Error in Step C --
            SQLBindParameter failed (param 3)\n"))
            return 0;
    }
}
```

Example of Retrieving Row and Collection Data from the Database

```
        jump = index;
        rc = SQLBindParameter (hRCStmt, 4, SQL_PARAM_INPUT, SQL_C_SHORT,
                                SQL_SMALLINT, 0, 0, &jump, 0, &cbJump);
        if (checkError (rc, SQL_HANDLE_STMT, hRCStmt, "Error in Step C --
                                SQLBindParameter failed (param 4)\n"))
            return 0;

        rc = SQLExecDirect(hRCStmt, "{ ? = call ifx_rc_fetch( ?, ?, ? ) }",
                                SQL_NTS);
        if (rc == SQL_NO_DATA_FOUND)
        {
            break;
        }
        else if (checkError (rc, SQL_HANDLE_STMT, hRCStmt, "Error in Step C
                                -- SQLExecDirect failed\n"))
            return 0;

        /* Display retrieved row */
        fprintf(stdout, "\t\t%d: %s\n", index, rc_data);
    }

    fprintf (stdout, "STEP C done...results retrieved\n");

    /* Free the statement handles */
    SQLFreeHandle (SQL_HANDLE_STMT, hSelectStmt);
    SQLFreeHandle (SQL_HANDLE_STMT, hRCStmt);

    return 1; /* no error */
}

/*
 * This function allocates the row and collection buffers, passes
 * them to the do_select() function, along with an appropriate select
 * statement and then frees all allocated handles.
 */
int main (long argc,
          char *argv[])
{
    /* Declare variables
    */

    /* Handles */
    SQLHDBC      hdbc;
    SQLHENV      henv;
    SQLHSTMT     hstmt;
    HINFX_RC     hrow, hlist;

    /* Miscellaneous variables */
}
```

Example of Retrieving Row and Collection Data from the Database

```
UCHAR      dsn[20];   /*name of the DSN used for connecting to the database*/
SQLRETURN  rc = 0;
int         in;

int         data_size = SQL_NTS;
char*      listSelectStmt = "SELECT fname, lname, contact_dates FROM customer";
char*      rowSelectStmt = "SELECT fname, lname, address FROM customer";

SQLINTEGER cbHlist = 0, cbHrow = 0;

/* STEP 1. Get data source name from command line (or use default)
**      Allocate environment handle and set ODBC version
**      Allocate connection handle
**      Establish the database connection
**      Allocate the statement handle
*/

/* If(dsn is not explicitly passed in as arg) */
if (argc != 2)
{
    /* Use default dsn - odbc_demo */
    fprintf (stdout, "\nUsing default DSN : %s\n", defDsn);
    strcpy ((char *)dsn, (char *)defDsn);
}
else
{
    /* Use specified dsn */
    strcpy ((char *)dsn, (char *)argv[1]);
    fprintf (stdout, "\nUsing specified DSN : %s\n", dsn);
}

/* Allocate the Environment handle */
rc = SQLAllocHandle (SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv);
if (rc != SQL_SUCCESS)
{
    fprintf (stdout, "Environment Handle Allocation failed\nExiting!!");
    return (1);
}

/* Set the ODBC version to 3.0 */
rc = SQLSetEnvAttr (henv, SQL_ATTR_ODBC_VERSION, (SQLPOINTER)SQL_OV_ODBC3, 0);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- SQLSetEnvAttr
    failed\nExiting!!"))
    return (1);

/* Allocate the connection handle */
rc = SQLAllocHandle (SQL_HANDLE_DBC, henv, &hdbc);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- Connection Handle
    Allocation failed\nExiting!!"))
    return (1);
```

Example of Retrieving Row and Collection Data from the Database

```
/* Establish the database connection */
rc = SQLConnect (hdbc, dsn, SQL_NTS, "", SQL_NTS, "", SQL_NTS);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- SQLConnect
    failed\n"))
    return (1);

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hstmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- Statement Handle
    Allocation failed\nExiting!!"))
    return (1);

fprintf (stdout, "STEP 1 done...connected to database\n");

/* STEP 2.  Allocate an unfixed collection handle
**          Retrieve database rows containing a list
**          Reset the statement parameters
*/

/* Allocate an unfixed list handle */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_BINARY,
    SQL_INFX_RC_LIST, sizeof(HINFX_RC), 0,
    &hlist, sizeof(HINFX_RC), &cbHlist);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
    (param 1) failed\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR,
    SQL_CHAR, 0, 0, (UCHAR *) "list", 0, &data_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
    (param 2) failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{? = call ifx_rc_create(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
    failed\n"))
    goto Exit;

/* Retrieve databse rows containing a list */
if (!do_select (hdbc, listSelectStmt, hlist))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLFreeStmt
    failed\n"))
    goto Exit;
```

Example of Retrieving Row and Collection Data from the Database

```
fprintf (stdout, "STEP 2 done...list data retrieved\n");
fprintf (stdout, "\nHit <Enter> to continue...");
in = getchar ();

/* STEP 3.  Allocate an unfixed row handle
**      Retrieve database rows containing a row
**      Reset the statement parameters
*/

/* Allocate an unfixed row handle */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_BINARY,
                      SQL_INFX_RC_ROW, sizeof(HINFX_RC), 0,
                      &hrow, sizeof(HINFX_RC), &cbHrow);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindParameter
(param 1) failed\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR,
                      SQL_CHAR, 0, 0, (UCHAR *) "row", 0, &data_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLBindParameter
(param 2) failed\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, "{? = call ifx_rc_create(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLExecDirect
failed\n"))
    goto Exit;

/* Retrieve database rows containing a row */
if (!do_select (hdbc, rowSelectStmt, hrow))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLFreeStmt
failed\n"))
    goto Exit;

fprintf (stdout, "STEP 3 done...row data retrieved\n");

/* STEP 4.  Free the row and list handles
*/

/* Free the row handle */
rc = SQLBindParameter(hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
                      SQL_INFX_RC_ROW, sizeof(HINFX_RC), 0, hrow,
                      sizeof(HINFX_RC), &cbHrow);
```


Example of Retrieving Row and Collection Data from the Database

```
rc = SQLExecDirect(hstmt, (UCHAR *)"{call ifx_rc_free(?)}", SQL_NTS);

/* Free the list handle */
rc = SQLBindParameter(hstmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_RC_LIST, sizeof(HINFX_RC), 0, hlist,
    sizeof(HINFX_RC), &cbHlist);

rc = SQLExecDirect(hstmt, (UCHAR *)"{call ifx_rc_free(?)}", SQL_NTS);

fprintf (stdout, "STEP 4 done...row and list handles freed\n");

Exit:

/* CLEANUP: Close the statement handle
**      Free the statement handle
**      Disconnect from the datasource
**      Free the connection and environment handles
**      Exit
*/

/* Close the statement handle */
SQLFreeStmt (hstmt, SQL_CLOSE);

/* Free the statement handle */
SQLFreeHandle (SQL_HANDLE_STMT, hstmt);

/* Disconnect from the data source */
SQLDisconnect (hdbc);

/* Free the environment handle and the database connection handle */
SQLFreeHandle (SQL_HANDLE_DBC, hdbc);
SQLFreeHandle (SQL_HANDLE_ENV, henv);

fprintf (stdout, "\n\nHit <Enter> to terminate the program...\n\n");
in = getchar ();
return (rc);
```

Creating a Row or Collection

The following code example, **rccreate.c**, creates a row and a list on the client, adds items to them and inserts them into the database. You can find the **rccreate.c** file in the **%INFORMIXDIR%\demo\clidemo** directory on UNIX platforms and in the **%INFORMIXDIR%\demo\odbcdemo** directory on Windows platforms. You can also find instructions on how to build the **odbc_demo** database in the same location.

Example of Creating a Row and a List on the Client

```
/*
**      rccreate.c
**
**      To create a collection & insert it into the database table
**
**      ODBC Functions:
**      SQLBindParameter
**      SQLConnect
**      SQLDisconnect
**      SQLExecDirect
**/

#include <stdio.h>
#include <stdlib.h>
#include <string.h>

#ifdef NO_WIN32
#include <io.h>
#include <windows.h>
#include <conio.h>
#endif /*NO_WIN32*/

#include "infxcli.h"

#define BUFFER_LEN      25
#define ERRMSG_LEN      200

UCHAR    defDsn[] = "odbc_demo";

int checkError (SQLRETURN      rc,
                SQLSMALLINT    handleType,
                SQLHANDLE      handle,
                char            *errmsg)
{
```

Example of Creating a Row and a List on the Client

```
SQLRETURN          retcode = SQL_SUCCESS;

SQLSMALLINT         errNum = 1;
SQLCHAR            sqlState[6];
SQLINTEGER          nativeError;
SQLCHAR            errMsg[ERRMSG_LEN];
SQLSMALLINT         textLengthPtr;

if ((rc != SQL_SUCCESS) && (rc != SQL_SUCCESS_WITH_INFO))
{
    while (retcode != SQL_NO_DATA)
    {
        retcode = SQLGetDiagRec (handleType, handle, errNum, sqlState,
                                &nativeError, errMsg, ERRMSG_LEN, &textLengthPtr);

        if (retcode == SQL_INVALID_HANDLE)
        {
            fprintf (stderr, "checkError function was called with an invalid
                          handle!!\n");
            return 1;
        }

        if ((retcode == SQL_SUCCESS) || (retcode == SQL_SUCCESS_WITH_INFO))
            fprintf (stderr, "ERROR: %d: %s : %s \n", nativeError, sqlState,
                    errMsg);

        errNum++;
    }

    fprintf (stderr, "%s\n", errMsg);
    return 1; /* all errors on this handle have been reported */
}
else
    return 0; /* no errors to report */
}

int main (long          argc,
          char          *argv[] )
{
    /* Declare variables
    */

    /* Handles */
    SQLHDBC          hdbc;
    SQLHENV           henv;
    SQLHSTMT          hstmt;

    HINFX_RC          hrow;
    HINFX_RC          hlist;

    /* Miscellaneous variables */
    UCHAR            dsn[20]; /*name of the DSN used for connecting to the database*/
    SQLRETURN         rc = 0;
    int              i, in;
```

Example of Creating a Row and a List on the Client

```
int          data_size = SQL_NTS;
short        position = SQL_INFX_RC_ABSOLUTE;
short        jump;

UCHAR        row_data[4][BUFFER_LEN] = {"520 Topaz Way", "Redwood City",
"CA", "94062"};
int          row_data_size = SQL_NTS;

UCHAR        list_data[2][BUFFER_LEN] = {"1991-06-20", "1993-07-17"};
int          list_data_size = SQL_NTS;

char*        insertStmt = "INSERT INTO customer VALUES (110, 'Roy', 'Jaeger',
?, ?)";
SQLINTEGER   cbHrow = 0, cbHlist = 0, cbPosition = 0, cbJump = 0;

/* STEP 1. Get data source name from command line (or use default)
**      Allocate environment handle and set ODBC version
**      Allocate connection handle
**      Establish the database connection
**      Allocate the statement handle
*/

/* If(dsn is not explicitly passed in as arg) */
if (argc != 2)
{
    /* Use default dsn - odbc_demo */
    fprintf (stdout, "\nUsing default DSN : %s\n", defDsn);
    strcpy ((char *)dsn, (char *)defDsn);
}
else
{
    /* Use specified dsn */
    strcpy ((char *)dsn, (char *)argv[1]);
    fprintf (stdout, "\nUsing specified DSN : %s\n", dsn);
}
/* Allocate the Environment handle */
rc = SQLAllocHandle (SQL_HANDLE_ENV, SQL_NULL_HANDLE, &henv);
if (rc != SQL_SUCCESS)
{
    fprintf (stdout, "Environment Handle Allocation failed\nExiting!!");
    return (1);
}

/* Set the ODBC version to 3.0 */
rc = SQLSetEnvAttr (henv, SQL_ATTR_ODBC_VERSION, (SQLPOINTER)SQL_OV_ODBC3, 0);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- SQLSetEnvAttr
failed\nExiting!!"))
    return (1);
```

Example of Creating a Row and a List on the Client

```
/* Allocate the connection handle */
rc = SQLAllocHandle (SQL_HANDLE_DBC, henv, &hdbc);
if (checkError (rc, SQL_HANDLE_ENV, henv, "Error in Step 1 -- Connection Handle
Allocation failed\nExiting!!"))
    return (1);

/* Establish the database connection */
rc = SQLConnect (hdbc, dsn, SQL_NTS, "", SQL_NTS, "", SQL_NTS);
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- SQLConnect
failed\n"))
    return (1);

/* Allocate the statement handle */
rc = SQLAllocHandle (SQL_HANDLE_STMT, hdbc, &hstmt );
if (checkError (rc, SQL_HANDLE_DBC, hdbc, "Error in Step 1 -- Statement Handle
Allocation failed\nExiting!!"))
    return (1);

fprintf (stdout, "STEP 1 done...connected to database\n");

/* STEP 2. Allocate fixed-type row handle -- this creates a non-null row
**      buffer, each of whose values is null, and can be updated.
**      Allocate a fixed-type list handle -- this creates a non-null
**      but empty list buffer into which values can be inserted.
**      Reset the statement parameters
*/

/* Allocate a fixed-type row handle -- this creates a row with
each value empty */

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_BINARY,
    SQL_INFX_RC_ROW, sizeof(HINFX_RC), 0,
    &hrow, sizeof(HINFX_RC), &cbHrow);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
(param 1) failed for row handle\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR, SQL_CHAR, 0, 0,
    (UCHAR *) "ROW(address1 VARCHAR(25), city VARCHAR(15), state VARCHAR(15),
    zip VARCHAR(5))", 0, &data_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
(param 2) failed for row handle\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, (UCHAR *) "{? = call ifx_rc_create(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
failed for row handle\n"))
    goto Exit;
```

Example of Creating a Row and a List on the Client

```
/* Allocate a fixed-type list handle */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_OUTPUT, SQL_C_BINARY,
    SQL_INFX_RC_LIST, sizeof(HINFX_RC), 0,
    &hlist, sizeof(HINFX_RC), &cbHlist);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
    (param 1) failed for list handle\n"))
    goto Exit;

data_size = SQL_NTS;
rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR,
    SQL_CHAR, 0, 0, (UCHAR *) "LIST (DATETIME YEAR TO DAY NOT NULL)",
    0, &data_size);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLBindParameter
    (param 2) failed for list handle\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, (UCHAR *) "{? = call ifx_rc_create(?)}", SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLExecDirect
    failed for list handle\n"))
    goto Exit;

/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 2 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 2 done...fixed-type row and collection handles
    allocated\n");

/* STEP 3. Update the elements of the fixed-type row buffer allocated
**      Insert elements into the fixed-type list buffer allocated
**      Reset the statement parameters
*/

/* Update elements of the row buffer */
for (i=0; i<4; i++)
{
    rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
        SQL_INFX_RC_ROW, sizeof(HINFX_RC), 0, hrow,
        sizeof(HINFX_RC), &cbHrow);
    if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
        SQLBindParameter (param 1) failed for row handle\n"))
        goto Exit;

    rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR,
        SQL_CHAR, BUFFER_LEN, 0, row_data[i], 0, &row_data_size);
    if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
        SQLBindParameter (param 2) failed for row handle\n"))
        goto Exit;
}
```

```

        rc = SQLBindParameter (hstmt, 3, SQL_PARAM_INPUT, SQL_C_SHORT,
                                SQL_SMALLINT, 0, 0, &position, 0, &cbPosition);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 3) failed for row handle\n"))
            goto Exit;

        jump = i + 1;
        rc = SQLBindParameter (hstmt, 4, SQL_PARAM_INPUT, SQL_C_SHORT,
                                SQL_SMALLINT, 0, 0, &jump, 0, &cbJump);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 4) failed for row handle\n"))
            goto Exit;

        rc = SQLExecDirect (hstmt, (UCHAR *)"{call ifx_rc_update(?, ?, ?, ?)}",
                                SQL_NTS);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLExecDirect
                                failed for row handle\n"))
            goto Exit;
    }

    /* Insert elements into the list buffer */
    for (i=0; i<2; i++)
    {
        rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
                                SQL_INFX_RC_LIST, sizeof(HINFX_RC), 0, hlist,
                                sizeof(HINFX_RC), &cbHlist);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 1) failed for list handle\n"))
            goto Exit;

        rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_CHAR,
                                SQL_DATE, 25, 0, list_data[i], 0, &list_data_size);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 2) failed for list handle\n"))
            goto Exit;

        rc = SQLBindParameter (hstmt, 3, SQL_PARAM_INPUT, SQL_C_SHORT,
                                SQL_SMALLINT, 0, 0, &position, 0, &cbPosition);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 3) failed for list handle\n"))
            goto Exit;

        jump = i + 1;
        rc = SQLBindParameter (hstmt, 4, SQL_PARAM_INPUT, SQL_C_SHORT,
                                SQL_SMALLINT, 0, 0, &jump, 0, &cbJump);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 --
                                SQLBindParameter (param 4) failed for list handle\n"))
            goto Exit;

        rc = SQLExecDirect (hstmt, (UCHAR *)"{call ifx_rc_insert( ?, ?, ?, ? )}",
                                SQL_NTS);
        if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLExecDirect
                                failed for list handle\n"))
            goto Exit;
    }

```

Example of Creating a Row and a List on the Client

```
/* Reset the statement parameters */
rc = SQLFreeStmt (hstmt, SQL_RESET_PARAMS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 3 -- SQLFreeStmt
    failed\n"))
    goto Exit;

fprintf (stdout, "STEP 3 done...row and list buffers populated\n");
/* STEP 4. Bind paramters for the row and list handles
**      Execute the insert statement to insert the new row
**      into table 'customer'
*/

rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_RC_COLLECTION, sizeof(HINFX_RC), 0, hrow,
    sizeof(HINFX_RC), &cbHrow);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
    failed (param 1)\n"))
    goto Exit;

rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_RC_COLLECTION, sizeof(HINFX_RC), 0, hlist,
    sizeof(HINFX_RC), &cbHlist);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLBindParameter
    failed (param 2)\n"))
    goto Exit;

rc = SQLExecDirect (hstmt, (UCHAR *)insertStmt, SQL_NTS);
if (checkError (rc, SQL_HANDLE_STMT, hstmt, "Error in Step 4 -- SQLExecDirect
    failed\n"))
    goto Exit;
fprintf (stdout, "STEP 4 done...new row inserted into table 'customer'\n");

/* STEP 5. Free the row and list handles
*/

/* Free the row handle */
rc = SQLBindParameter (hstmt, 1, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_RC_ROW, sizeof(HINFX_RC), 0, hrow,
    sizeof(HINFX_RC), &cbHrow);

rc = SQLExecDirect(hstmt, (UCHAR *)"{call ifx_rc_free(?)}", SQL_NTS);

/* Free the list handle */
rc = SQLBindParameter (hstmt, 2, SQL_PARAM_INPUT, SQL_C_BINARY,
    SQL_INFX_RC_LIST, sizeof(HINFX_RC), 0, hlist,
    sizeof(HINFX_RC), &cbHlist);

rc = SQLExecDirect(hstmt, (UCHAR *)"{call ifx_rc_free(?)}", SQL_NTS);

fprintf (stdout, "STEP 5 done...row and list handles freed\n");
```



```
Exit:

/* CLEANUP: Close the statement handle
**      Free the statement handle
**      Disconnect from the datasource
**      Free the connection and environment handles
**      Exit
*/

/* Close the statement handle */
SQLFreeStmt (hstmt, SQL_CLOSE);

/* Free the statement handle */
SQLFreeHandle (SQL_HANDLE_STMT, hstmt);

/* Disconnect from the data source */
SQLDisconnect (hdbc);

/* Free the environment handle and the database connection handle */
SQLFreeHandle (SQL_HANDLE_DBC, hdbc);
SQLFreeHandle (SQL_HANDLE_ENV, henv);

fprintf (stdout, "\n\nHit <Enter> to terminate the program...\n\n");
in = getchar ();
return (rc);
```

Modifying a Row or Collection

The following table provides an overview of the functions that Informix ODBC Driver provides for modifying rows and collections.

Function	Modification	Row	Collection
ifx_rc_delete()	Delete an element	No	Yes
ifx_rc_insert()	Insert an element	No	Yes (See the following table.)
ifx_rc_setnull()	Set the row or collection to null	Yes	Yes
ifx_rc_update()	Update the value of an element	Yes	Yes

The following table describes the collection locations into which you can insert an element. You can insert an element only at the end of a SET or MULTiset because elements in these types of collections do not have ordered positions.

	Beginning	Middle	End
List	Yes	Yes	Yes
Multiset	No	No	Yes
Set	No	No	Yes



Tip: If you only need to insert or update a row or collection column with literal values, you do not need to use a row or collection buffer. Instead, you can explicitly list the literal value in either the INTO clause of the INSERT statement or the SET clause of the UPDATE statement.

Seek Position

Each row and collection maintains a seek position that points to the current element in the row or collection. When the row or collection is created, the seek position points to the first element that is in the row or collection. All calls to client functions share the same seek position for a row or collection buffer. Therefore, one client function can affect the seek position for another client function that uses the same buffer handle. The following table describes how client functions use and modify the seek position.

Client Function	Acts On	Changes
ifx_rc_delete()	At the specified position	Sets the seek position to the value after the one that was deleted
ifx_rc_fetch()	At the specified position	Set the seek position to the specified position
ifx_rc_insert()	Before the specified position	Set the seek position to the specified position
ifx_rc_update()	At the specified position	Set the seek position to the specified position

Retrieving Information About a Row or Collection

The following table provides an overview of the functions that Informix ODBC Driver provides for retrieving information about rows and collections. The **ifx_rc_describe()** function returns the data types of elements in a row or collection. [Chapter 7, “Client Functions,”](#) describes these functions.

Function	Information	Page
ifx_rc_count()	Number of columns	7-42
ifx_rc_describe()	Data type information	7-46
ifx_rc_isnull()	Value that indicates whether or not it is null	7-53
ifx_rc_typespec()	Type specification	7-55

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In This Chapter

The information in this chapter applies only if your database server is Informix Dynamic Server with Universal Data Option.

This chapter describes the Informix ODBC Driver client functions. Use these functions to access, and manipulate smart large objects and rows and collections.

Calling a Client Function

This section describes the syntax of client functions, their input/output arguments, return values, and SQL_BIGINT.

SQL Syntax

The SQL syntax for a client function is:

```
{? = call client_function(?, ?, ...)}
```

Use the first parameter marker (“?”) only when the first parameter is an output parameter.

The following code example invokes a client function when the first parameter is an output parameter:

```
{? = call ifx_lo_open(?, ?, ?)}
```

The following code example invokes a client function when the first parameter is not an output parameter:

```
{call ifx_lo_create(?, ?, ?, ?)}
```

Function Syntax

The database server and the application both partially implement each client function. You can execute a client function with either **SQLPrepare()** and **SQLExecute()** or with **SQLExecDirect()**. You need to call **SQLBindParameter()** or **SQLBindCol()** to bind each parameter before you call **SQLExecute()** or **SQLExecDirect()**.

To execute a client function with SQLPrepare() and SQLExecute()

1. Prepare the SQL statement for the client function.
2. Bind the parameters.
3. Execute the SQL statement.

The following code examples illustrates these steps for **ifx_lo_open()**:

```
rc = SQLPrepare(hstmt, "{? = call ifx_lo_open(?, ?,
    ?)}", SQL_NTS);
rc = SQLBindParameter(...);
rc = SQLExecute(hstmt);
```

To execute a client function with SQLExecDirect()

1. Bind the parameters.
2. Execute the SQL statement.

The following code example illustrates these steps for **ifx_lo_open()**:

```
rc = SQLBindParameter(...);
rc = SQLExecDirect(hstmt, "{? = call ifx_lo_open(?, ?,
    ?)}", SQL_NTS);
```

Input/Output Arguments

Most of the input/output parameters for client functions are output parameters from the perspective of the client application. However, a client function that accepts an input/output parameter initializes the parameter internally and sends it to the database server with the request to execute the client function. Therefore, you need to pass these parameters as input/output parameters to the driver.

SQL_BIGINT

Dynamic Server with UD Option supports the INT8 Informix SQL data type. By default, the driver maps INT8 to the SQL_BIGINT Informix ODBC Driver SQL data type and to the SQL_C_CHAR default Informix ODBC Driver C data type. However, client functions cannot access all the data type conversion functions. Therefore, you must use a data type other than SQL_C_CHAR when you use a value of type SQL_BIGINT.

For example, before you call **ifx_lo_specset_estbytes()**, you need to bind a variable for the *estbytes* input argument. Because *estbytes* is an SQL_BIGINT, you would normally bind *estbytes* to an SQL_C_CHAR. However, SQL_C_CHAR does not work for SQL_BIGINT for a client function. The following code example illustrates how to bind *estbytes* to an SQL_C_LONG instead of an SQL_C_CHAR for **ifx_lo_specset_estbytes()**:

```
rc = SQLBindParameter(hstmt, 2, SQL_PARAM_INPUT, SQL_C_LONG,
    SQL_BIGINT, (UDWORD)0, 0, &estbytes, sizeof(estbytes),
    NULL);
rc = SQLExecDirect(hstmt, "{call ifx_lo_specset_estbytes(?,
    ?)}", SQL_NTS);
```

Return Codes

The client functions do not provide return codes. For success or failure information, see the return codes for the Informix ODBC Driver function with which you call the client function (**SQLExecDirect()** or **SQLExecute()**).

Functions for Smart Large Objects

This section describes each client function that the driver provides for smart large objects. The functions are listed alphabetically. For more information, see [Chapter 5, “Working with Smart Large Objects.”](#)

ifx_lo_alter()

The **ifx_lo_alter()** function alters the storage characteristics of a smart large object.

Syntax

```
ifx_lo_alter(loptr, lospec)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>loptr</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object pointer structure
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure

Usage

The **ifx_lo_alter()** function performs the following steps to update the storage characteristics of a smart large object:

1. Gets an exclusive lock for the smart large object.
2. Uses the characteristics that are in the *lospec* smart-large-object specification structure to update the storage characteristics of the smart large object. The **ifx_lo_alter()** function lets you change the following storage characteristics:
 - Logging characteristics
 - Last-access time characteristics
 - Extent size
3. Unlocks the smart large object.

As an alternative to calling this function, you can call one of the following functions if you want to change only one of these characteristics:

- **ifx_lo_specset_flags()**
- **ifx_lo_specset_extsz()**

ifx_lo_close()

The **ifx_lo_close()** function closes a smart large object.

Syntax

```
ifx_lo_close(lofd)
```

Arguments

The function accepts the following argument.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor

Usage

The **ifx_lo_close()** function closes a smart large object. During this function, the database server tries to unlock the smart large object. If the isolation mode is repeatable read or if the lock is an exclusive lock, the database server does not release the lock until the end of the transaction.

Tip: *If you do not update a smart large object inside a BEGIN WORK transaction block, each update is a separate transaction.*



ifx_lo_col_info()

The **ifx_lo_col_info()** function updates a smart-large-object specification structure with column-level storage characteristics.

Syntax

```
ifx_lo_col_info(colname, lospec)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
colname	SQL_CHAR	Input	Pointer to a buffer that contains the name of a database column This value must be in the following format: database@server_name:table.column If the column is in a database that is ANSI compliant, you can include the owner name. In this case, use the following format: database@server_name:owner.table.column
lospec	SQL_INFX_UDT_FIXED	I/O	Smart-large-object specification structure

Usage

The **ifx_lo_col_info()** function sets the fields for a smart-large-object specification structure to the storage characteristics for the *colname* database column. If the specified column does not have column-level storage characteristics defined, the database server uses the storage characteristics that are inherited.

Important: You must call **ifx_lo_def_create_spec()** before you call this function.



ifx_lo_create()

The **ifx_lo_create()** function creates and opens a new smart large object.

Syntax

```
ifx_lo_create(lospec, flags, loptr, lofd)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure that contains storage characteristics for the new smart large object
<i>flags</i>	SQL_INTEGER	Input	Mode in which to open the new smart large object. For more information, see “Access Modes” on page 5-23 .
<i>loptr</i>	SQL_INFX_UDT_FIXED	I/O	Smart-large-object pointer structure
<i>lofd</i>	SQL_INTEGER	Output	Smart-large-object file descriptor. This file descriptor is only valid within the current database connection.

Usage

The **ifx_lo_create()** function performs the following steps to create and open a new smart large object:

1. Creates a smart-large-object pointer structure
2. Assigns a pointer to this structure and returns this pointer in *loptr*

3. Assigns storage characteristics for the smart large object from the smart-large-object specification structure that *lospec* indicates
If *lospec* is null, **ifx_lo_create()** uses the system-specified storage characteristics. If the smart-large-object specification structure exists but does not contain storage characteristics, **ifx_lo_create()** uses the storage characteristics from the inheritance hierarchy.
4. Opens the smart large object in the access mode that *flags* specifies
5. Associates the smart large object with the current connection
When you close this connection, the database server deallocates any associated smart large objects that have a reference count of zero. The reference count indicates the number of database columns that refer to the smart large object.
6. Returns a file descriptor that identifies the smart large object

The database server uses the default parameters that the call to **ifx_lo_create()** establishes to determine whether or not to lock or log subsequent operations on the smart large object.

ifx_lo_def_create_spec()

The **ifx_lo_def_create_spec()** function creates a smart-large-object specification structure.

Syntax

```
ifx_lo_def_create_spec(lospec)
```

Arguments

The function accepts the following argument.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	I/O	Smart-large-object specification structure

Usage

The **ifx_lo_def_create_spec()** function creates a smart-large-object specification structure and initializes the fields to null values. If you do not change these values, the null values tell the database server to use the system-specified defaults for the storage characteristics of the smart large object.

ifx_lo_open()

The **ifx_lo_open()** function opens a smart large object.

Syntax

```
ifx_lo_open(lofd, loptr, flags)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Output	Smart-large-object file descriptor. This file descriptor is only valid within the current database connection.
<i>loptr</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object pointer structure
<i>flags</i>	SQL_INTEGER	Input	Mode in which to open the smart large object. For more information, see “Access Modes” on page 5-23 .

Usage

The **ifx_lo_open()** function performs the following steps to open a smart large object:

1. Opens the *loptr* smart large object in the access mode that *flags* specifies
2. Sets the seek position to byte zero
3. Locks the smart large object



Important: The database server does not check access permissions on the smart large object. Your application must make sure that the end user or application is trusted.

As the following table describes, the access mode determines the type of lock.

Access Mode	Type of Lock
Dirty read	No lock
Read only	Shared lock
Write only, write / append, or read / write	Update lock. When you call ifx_lo_write() or ifx_lo_writewithseek() for the smart large object, the database server promotes the lock to an exclusive lock.

The database server loses this lock when the current transaction terminates. The database server obtains the lock again the next time you call a function that needs a lock.

As an alternative, you can use a BEGIN WORK transaction block and place a COMMIT WORK or ROLLBACK WORK statement after the last statement that needs to use the lock.

4. Associates the smart large object with the current connection

When you close this connection, the database server deallocates any associated smart large objects that have a reference count of zero. The reference count indicates the number of database columns that refer to the smart large object.

5. Returns a file descriptor that identifies the smart large object

The database server uses the default parameters that the call to **ifx_lo_open()** establishes to determine whether or not to lock or log subsequent operations on the smart large object.

ifx_lo_read()

The **ifx_lo_read()** function reads data from an open smart large object.

Syntax

```
ifx_lo_read(lofd, buf)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>buf</i>	SQL_CHAR	Output	Pointer to a character buffer into which the function will read the data

Usage

The **ifx_lo_read()** function reads data from an open smart large object. The read begins at the current seek position for *lofd*. You can call **ifx_lo_tell()** to obtain the current seek position.

The **ifx_lo_read()** function reads *cbValueMax* bytes of data. *cbValueMax* is an input argument for **SQLBindParameter()** and **SQLBindCol()**. Neither the size of *buf* nor *cbValueMax* can exceed 2 gigabytes. To read a smart large object that is larger than 2 gigabytes, read it in 2-gigabyte chunks. The **ifx_lo_read()** function reads this data into the user-defined buffer to which *buf* points.

If **SQLBindParameter()** or **SQLBindCol()** returns SQL_SUCCESS, then *pcbValue*, which is an argument for each of these functions, contains the number of bytes that the function read from the smart large object. If **SQLBindParameter()** or **SQLBindCol()** returns SQL_SUCCESS_WITH_INFO, then *pcbValue* contains the number of bytes that are available to read from the smart large object.

ifx_lo_readwithseek()

The **ifx_lo_readwithseek()** function performs a seek operation and then reads data from an open smart large object.

Syntax

```
ifx_lo_readwithseek(lofd, buf, offset, whence)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>buf</i>	SQL_CHAR	Output	Pointer to a character buffer into which the function will read the data
<i>offset</i>	SQL_BIGINT	Input	Offset from the starting seek position, in bytes. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>offset</i> , use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5 .
<i>whence</i>	SQL_INTEGER	Input	Starting seek position. The possible values are: ■ LO_SEEK_CUR: The current seek position in the smart large object ■ LO_SEEK_END: The end of the smart large object ■ LO_SEEK_SET: The start of the smart large object

Usage

The **ifx_lo_readwithseek()** function performs a seek operation and then reads data from an open smart large object. The read begins at the seek position of *lofd* that the *offset* and *whence* arguments indicate.

The **ifx_lo_readwithseek()** function reads *cbValueMax* bytes of data. *cbValueMax* is an input argument for **SQLBindParameter()** and **SQLBindCol()**. Neither the size of *buf* nor *cbValueMax* can exceed 2 gigabytes. To read a smart large object that is larger than 2 gigabytes, read it in 2-gigabyte chunks. The **ifx_lo_readwithseek()** function reads this data into the user-defined buffer to which *buf* points.

If **SQLBindParameter()** or **SQLBindCol()** returns SQL_SUCCESS, then *pcbValue*, which is an argument for each of these functions, contains the number of bytes that the function read from the smart large object. If **SQLBindParameter()** or **SQLBindCol()** returns SQL_SUCCESS_WITH_INFO, then *pcbValue* contains the number of bytes that are available to read from the smart large object.

ifx_lo_seek()

The **ifx_lo_seek()** function sets the file position for the next read or write operation on an open smart large object.

Syntax

```
ifx_lo_seek(lofd, offset, whence, seek_pos)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>offset</i>	SQL_BIGINT	Input	Offset from the starting seek position, in bytes. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>offset</i> , use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5 .
<i>whence</i>	SQL_INTEGER	Input	Starting seek position. The possible values are: ■ LO_SEEK_CUR: The current seek position in the smart large object ■ LO_SEEK_END: The end of the smart large object ■ LO_SEEK_SET: The start of the smart large object
<i>seek_pos</i>	SQL_BIGINT	I/O	New seek position. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>seek_pos</i> , use SQL_C_LONG. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_seek()** function sets the seek position of *lofd* to the position that the *offset* and *whence* arguments indicate.

ifx_lo_specget_estbytes()

The **ifx_lo_specget_estbytes()** function gets the estimated number of bytes from a smart-large-object specification structure.

Syntax

```
ifx_lo_specget_estbytes(lospec, estbytes)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>estbytes</i>	SQL_BIGINT	Output	Estimated final size of the smart large object, in bytes. This estimate is an optimization hint for the smart-large-object optimizer. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>estbytes</i> , use SQL_C_LONG. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_specget_estbytes()** function gets the estimated number of bytes from a smart-large-object specification structure.

ifx_lo_specget_extsz()

The **ifx_lo_specget_extsz()** function gets the allocation extent from a smart-large-object specification structure.

Syntax

```
ifx_lo_specget_extsz(lospec, extsz)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>extsz</i>	SQL_INTEGER	Output	Extent size of the smart large object, in bytes. This value is the size of the allocation extents to be allocated for the smart large object when the database server writes beyond the end of the current extent. This value overrides the estimate that the database server generates for how large an extent should be.

Usage

The **ifx_lo_specget_extsz()** function gets the allocation extent from a smart-large-object specification structure.

ifx_lo_specget_flags()

The **ifx_lo_specget_flags()** function gets the create-time flags from a smart-large-object specification structure.

Syntax

```
ifx_lo_specget_flags(lospec, flags)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>flags</i>	SQL_INTEGER	Output	Create-time flags. For more information, see “Access Modes” on page 5-23 .

Usage

The **ifx_lo_specget_flags()** function gets the create-time flags from a smart-large-object specification structure.

ifx_lo_specget_maxbytes()

The **ifx_lo_specget_maxbytes()** function gets the maximum number of bytes from a smart-large-object specification structure.

Syntax

```
ifx_lo_specget_maxbytes(lospec, maxbytes)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>maxbytes</i>	SQL_BIGINT	Input	Maximum size, in bytes, of the smart large object. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>maxbytes</i> , use SQL_C_LONG. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_specget_maxbytes()** function gets the maximum number of bytes from a smart-large-object specification structure.

ifx_lo_specget_sbospace()

The **ifx_lo_specget_sbospace()** function gets the sbospace name from a smart-large-object specification structure.

Syntax

```
ifx_lo_specget_sbospace(lospec, sospace)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>sospace</i>	SQL_CHAR	Output	Name of the sbospace for the smart large object. An sbospace name can be up to 18 characters long and must be null terminated.

Usage

The **ifx_lo_specget_sbospace()** function returns the name of the sbospace in which to store the smart large object. The function copies up to (*pcbValue*-1) bytes into the *sospace* buffer and makes sure that it is null terminated. *pcbValue* is an argument for **SQLBindParameter()** and **SQLBindCol()**.

ifx_lo_specset_estbytes()

The **ifx_lo_specset_estbytes()** function sets the estimated number of bytes in a smart-large-object specification structure.

Syntax

```
ifx_lo_specset_estbytes(lospec, estbytes)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>estbytes</i>	SQL_BIGINT	Input	Estimated final size of the smart large object, in bytes. This estimate is an optimization hint for the smart large object optimizer. This value cannot exceed 2 gigabytes. If you do not specify an <i>estbytes</i> value when you create a new smart large object, the database server gets the value from the inheritance hierarchy of storage characteristics. Do not change this system value unless you know the estimated size for the smart large object. If you do set the estimated size for a smart large object, do not specify a value much higher than the final size of the smart large object. Otherwise, the database server might allocate unused storage. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>estbytes</i>, use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5.

Usage

The **ifx_lo_specset_estbytes()** function sets the estimated number of bytes in a smart-large-object specification structure.

ifx_lo_specset_extsz()

The **ifx_lo_specset_extsz()** function sets the allocation extent size in a smart-large-object specification structure.

Syntax

```
ifx_lo_specset_extsz(lospec, extsz)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>extsz</i>	SQL_INTEGER	Input	Extent size of the smart large object, in bytes. This value specifies the size of the allocation extents to be allocated for the smart large object when the database server writes beyond the end of the current extent. This value overrides the estimate that the database server generates for how large an extent should be. If you do not specify an <i>extsz</i> value when you create a new smart large object, the database server attempts to optimize the extent size based on past operations on the smart large object and other storage characteristics (such as maximum bytes) that it obtains from the inheritance hierarchy of storage characteristics. Do not change this system value unless you know the allocation extent size for the smart large object. Only applications that encounter severe storage fragmentation should ever set the allocation extent size. For such applications, make sure you know exactly the number of bytes by which to extend the smart large object.

Usage

The **ifx_lo_specset_extsz()** function sets the allocation extent size in a smart-large-object specification structure.

ifx_lo_specset_flags()

The **ifx_lo_specset_flags()** function sets the create-time flags in a smart-large-object specification structure.

Syntax

```
ifx_lo_specset_flags(lospec, flags)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>flags</i>	SQL_INTEGER	Input	Create-time flags. For more information, see “Create-Time Flags” on page 5-7 .

Usage

The **ifx_lo_specset_flags()** function sets the create-time flags in a smart-large-object specification structure.

ifx_lo_specset_maxbytes()

The **ifx_lo_specset_maxbytes()** function sets the maximum number of bytes in a smart-large-object specification structure.

Syntax

```
ifx_lo_specset_maxbytes(lospec, maxbytes)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>maxbytes</i>	SQL_BIGINT	Input	Maximum size of the smart large object, in bytes. This value cannot exceed 2 gigabytes. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>maxbytes</i> , use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_specset_maxbytes()** function sets the maximum number of bytes in a smart-large-object specification structure.

ifx_lo_specset_sbospace()

The **ifx_lo_specset_sbospace()** function sets the sbospace name in a smart-large-object specification structure.

Syntax

```
ifx_lo_specset_sbospace(lospec, sbospace)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lospec</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object specification structure
<i>sbospace</i>	SQL_CHAR	Input	Name of the sbospace for the smart large object. An sbospace name can be up to 18 characters long and must be null terminated. If you do not specify an <i>sbospace</i> when you create a new smart large object, the database server obtains the sbospace name from either the column information or from the SBSPACENAME parameter of the ONCONFIG file.

Usage

The **ifx_lo_specset_sbospace()** function uses *pcbValue* to determine the length of the sbospace name. *pcbValue* is an argument for **SQLBindParameter()** and **SQLBindCol()**.

ifx_lo_stat()

The **ifx_lo_stat()** function initializes a smart-large-object status structure.

Syntax

```
ifx_lo_stat(lofd, lostat)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>lostat</i>	SQL_INFX_UDT_FIXED	I/O	Smart-large-object status structure

Usage

Before you call **ifx_lo_stat()**, call **SQLGetInfo()** to get the size of the smart-large-object status structure. Use this size to allocate memory for the structure.

The **ifx_lo_stat()** function allocates a smart-large-object status structure and initializes it with the status information for the smart large object.

ifx_lo_stat_atime()

The **ifx_lo_stat_atime()** function retrieves the last access time for a smart large object.

Syntax

```
ifx_lo_stat_atime(lostat, atime)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lostat</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object status structure
<i>atime</i>	SQL_INTEGER	Output	Time of the last access for a smart large object, in seconds. The database server maintains the time of last access only if the LO_KEEP_LASTACCESS_TIME flag is set for the smart large object.

Usage

The **ifx_lo_stat_atime()** function retrieves the last access time for a smart large object.

ifx_lo_stat_cspec()

The **ifx_lo_stat_cspec()** function retrieves a smart-large-object specification structure.

Syntax

```
ifx_lo_stat_cspec(lostat, lospec)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lostat</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object status structure
<i>lospec</i>	SQL_INFX_UDT_FIXED	Output	Smart-large-object specification structure

Usage

The **ifx_lo_stat_cspec()** function retrieves a smart-large-object specification structure and returns a pointer to the structure.

ifx_lo_stat_ctime()

The **ifx_lo_stat_ctime()** function retrieves the time of the last change of a smart large object.

Syntax

```
ifx_lo_stat_ctime(lostat, ctime)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lostat</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object status structure
<i>ctime</i>	SQL_INTEGER	Output	Time of the last change of the smart large object, in seconds. The last change in status includes modification of storage characteristics, including a change in the number of references and writes to the smart large object.

Usage

The **ifx_lo_stat_ctime()** function retrieves the time of the last change of a smart large object.

ifx_lo_stat_refcnt()

The **ifx_lo_stat_refcnt()** function retrieves the number of references to a smart large object.

Syntax

```
ifx_lo_stat_refcnt(lostat, refcount)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lostat</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object status structure
<i>refcount</i>	SQL_INTEGER	Output	Number of references to a smart large object. This value is the number of database columns that refer to the smart large object.

Usage

The **ifx_lo_stat_refcnt()** function retrieves the number of references to a smart large object.

A database server can remove a smart large object and reuse any resources that are allocated to it when the reference count for the smart large object is zero and one of the following events occurs:

- The transaction in which the reference count is decremented to zero commits.
- The connection during which the smart large object was created terminates, but the reference count is not incremented.

The database server increments a reference counter when it stores the smart-large-object pointer structure for a smart large object in a row.

ifx_lo_stat_size()

The **ifx_lo_stat_size()** function retrieves the size of a smart large object.

Syntax

```
ifx_lo_stat_size(lostat, size)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lostat</i>	SQL_INFX_UDT_FIXED	Input	Smart-large-object status structure
<i>size</i>	SQL_BIGINT	Output	Size of a smart large object, in bytes. This value cannot exceed 2 gigabytes. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>size</i> , use SQL_C_LONG. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_stat_size()** function retrieves the size of a smart large object.

ifx_lo_tell()

The **ifx_lo_tell()** function retrieves the current file or seek position for an open smart large object.

Syntax

```
ifx_lo_tell(lofd, seek_pos)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>seek_pos</i>	SQL_BIGINT	I/O	New seek position, which is the offset for the next read or write operation on the smart large object. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>seek_pos</i> , use SQL_C_LONG. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_tell()** function retrieves the current file or seek position for an open smart large object.

This function works correctly for smart large objects up to 2 gigabytes in size.

ifx_lo_truncate()

The **ifx_lo_truncate()** function truncates a smart large object at the specified position.

Syntax

```
ifx_lo_truncate(lofd, offset)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>offset</i>	SQL_BIGINT	Input	End of the smart large object. If this value exceeds the end of the smart large object, the function extends the smart large object. If this value is less than the end of the smart large object, the database server reclaims all storage from the offset position to the end of the smart large object. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>offset</i> , use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5 .

Usage

The **ifx_lo_truncate()** function sets the end of a smart large object to the location that the *offset* argument specifies.

ifx_lo_write()

The **ifx_lo_write()** function writes data to an open smart large object.

Syntax

```
ifx_lo_write(lofd, buf)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor
<i>buf</i>	SQL_CHAR	Input	Buffer that contains the data that the function writes to the smart large object. The size of the buffer cannot exceed 2 gigabytes.

Usage

The **ifx_lo_write()** function writes data to an open smart large object. The write begins at the current seek position for *lofd*. You can call **ifx_lo_tell()** to obtain the current seek position.

The **ifx_lo_write()** function writes *cbValueMax* bytes of data. *cbValueMax* is an input argument for **SQLBindParameter()** and **SQLBindCol()**. Neither the size of *buf* nor *cbValueMax* can exceed 2 gigabytes. To write to a smart large object that is larger than 2 gigabytes, write to it in 2-gigabyte chunks. The **ifx_lo_write()** function gets the data from the user-defined buffer to which *buf* points.

If **SQLExecDirect()** or **SQLExecute()** returns SQL_SUCCESS_WITH_INFO, then the database server wrote less than *cbValueMax* bytes of data to the smart large object and *pcbValue*, which is an argument for each of these functions, contains the number of bytes that the function wrote. This condition can occur when the sbospace runs out of space.

ifx_lo_writewithseek()

The **ifx_lo_writewithseek()** function performs a seek operation and then writes data to an open smart large object.

Syntax

```
ifx_lo_writewithseek(lofd, buf, offset, whence)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>lofd</i>	SQL_INTEGER	Input	Smart-large-object file descriptor.
<i>buf</i>	SQL_CHAR	Input	Buffer that contains the data that the function writes to the smart large object. The size of the buffer must not exceed 2 gigabytes.
<i>offset</i>	SQL_BIGINT	Input	Offset from the starting seek position, in bytes. Instead of using the default Informix ODBC Driver C data type of SQL_C_CHAR for <i>offset</i> , use SQL_C_LONG or SQL_C_SHORT. For more information, see “SQL_BIGINT” on page 7-5 .
<i>whence</i>	SQL_INTEGER	Input	Starting seek position. The possible values are: ■ LO_SEEK_CUR: The current seek position in the smart large object ■ LO_SEEK_END: The end of the smart large object ■ LO_SEEK_SET: The start of the smart large object

Usage

The **ifx_lo_writewithseek()** function performs a seek operation and then writes data to an open smart large object. The write begins at the seek position of *lofd* that the *offset* and *whence* arguments indicate.

The **ifx_lo_writewithseek()** function writes *cbValueMax* bytes of data. *cbValueMax* is an input argument for **SQLBindParameter()** and **SQLBindCol()**. Neither the size of *buf* nor *cbValueMax* can exceed 2 gigabytes. To write to a smart large object that is larger than 2 gigabytes, write to it in 2-gigabyte chunks. The **ifx_lo_writewithseek()** function gets the data from the user-defined buffer to which *buf* points.

If **SQLExecDirect()** or **SQLExecute()** returns `SQL_SUCCESS_WITH_INFO`, then the database server wrote less than *cbValueMax* bytes of data to the smart large object and *pcbValue*, which is an argument for each of these functions, contains the number of bytes that the function wrote. This condition can occur when the sbspace runs out of space.

Functions for Rows and Collections

This section describes each client function that Informix ODBC Driver provides for rows and collections. The functions are listed alphabetically. For more information about rows and collections, see [Chapter 6, “Working with Rows and Collections.”](#)

ifx_rc_count()

The **ifx_rc_count()** function returns the number of elements or fields that are in a row or collection.

Syntax

```
ifx_rc_count(rowcount, rchandle)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rowcount</i>	SQL_SMALLINT	Output	Number of elements or fields that are in the row or collection
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer

Usage

The **ifx_rc_count()** function returns the number of elements or fields that are in the row or collection.

ifx_rc_create()

The **ifx_rc_create()** function creates a buffer for a row or collection.

Syntax

```
ifx_rc_create(rchandle, typespec)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Output	Handle for a row or collection buffer
<i>typespec</i>	SQL_CHAR	Input	Type specification for the buffer. See the following table.

The following table describes the syntax for the *typespec* argument.

Type of Buffer	Syntax	Example
Unfixed-type collection	COLLECTION	COLLECTION
Fixed-type collection	COLLECTION {SET MULTISET LIST} (<i>type</i> not null) or {SET MULTISET LIST} (<i>type</i> not null) where <i>type</i> is the Informix SQL data type for the elements in the collection	COLLECTION SET (int not null) or SET (int not null)

Type of Buffer	Syntax	Example
Unfixed-type row	ROW	ROW
Fixed-type row	<pre>ROW ["name"] (field_id type [, field_id type, ...]) where:</pre> ■ <i>name</i> is an optional name for the entire row ■ <i>field_id</i> is the name for a field ■ <i>type</i> is the Informix SQL data type for the field	<pre>ROW "employee_t" (name char(255), id_num int, dept int)</pre>

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Usage

The **ifx_rc_create()** function allocates memory for a row or collection buffer and returns a handle to the buffer. The following table describes how the function initializes the buffer.

Type of Buffer	Initial Value for the Row or Collection	Initial Value for the Contents of the Row or Collection
Fixed-type collection	Non-null	Empty
Fixed-type row	Non-null	Each value is null
Unfixed-type collection	Null	Empty
Unfixed-type row	Null	Empty

For a row, the function sets the seek position to element number one. An empty collection buffer does not have a seek position.

ifx_rc_delete()

The **ifx_rc_delete()** function deletes an element from a collection.

Syntax

```
ifx_rc_delete(rchandle, action, jump)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a collection buffer
<i>action</i>	SQL_SMALLINT	Input	Location of the element relative to the seek position. The possible values are: ■ SQL_INFX_RC_ABSOLUTE: Element number <i>jump</i> where the first element in the buffer is element number one ■ SQL_INFX_RC_CURRENT: Current element ■ SQL_INFX_RC_FIRST: First element ■ SQL_INFX_RC_LAST: Last element ■ SQL_INFX_RC_NEXT: Next element ■ SQL_INFX_RC_PRIOR: Previous element ■ SQL_INFX_RC_RELATIVE: Element that is <i>jump</i> elements past the current element
<i>jump</i>	SQL_SMALLINT	Input	Offset when <i>action</i> is SQL_INFX_RC_ABSOLUTE or SQL_INFX_RC_RELATIVE

Usage

The **ifx_rc_delete()** function deletes an element from a collection from the location that is specified by *action* and *jump*. The function sets the seek position to the value that was just deleted. It is not possible to delete an element from a row.

ifx_rc_describe()

The **ifx_rc_describe()** function returns descriptive information about the data type for a row or collection or for an element that is in a row or collection.

Syntax

```
ifx_rc_describe(rchandle, fieldnum, fieldname, typecode,
               columnsize, decdigits, nullable, typename, typeowner)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer
<i>fieldnum</i>	SQL_SMALLINT	Input	Field number. If this value is 0, the function returns information for the entire row or collection. For a collection, any value other than 0 causes the function to return information for the elements that are in the collection. For a row, this value specifies the element for which the function returns information.
<i>fieldname</i>	SQL_CHAR	Output	Field name. The function returns this value only for an element that is in a row.
<i>typecode</i>	SQL_SMALLINT	Output	Informix ODBC Driver SQL data type of the element
<i>columnsize</i>	SQL_INTEGER	Output	Column size. For a character element, this value is the size of the column, in bytes. For a numeric element, this value is the precision. For other data types, the function does not return this value.
<i>decdigits</i>	SQL_SMALLINT	Output	Decimal digits. For a numeric element, this value is the number of digits to the right of the decimal point. For other data types, the function does not return this value.

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Argument	Type	Use	Description
<i>nullable</i>	SQL_SMALLINT	Output	Null indicator. The possible values are: ■ SQL_NO_NULLS ■ SQL_NULLABLE
<i>typename</i>	SQL_CHAR	Output	Type name. For a named row, this value is the name of the row. For collections and unnamed rows, the function does not return this value.
<i>typeowner</i>	SQL_CHAR	Output	Type owner. This value is the name of the owner of the data type. This name can be up to 18 characters long.

(2 of 2)

Usage

The **ifx_rc_describe()** function returns information about the data type for a row or collection or for an element that is in a row or collection. For elements that are in a collection, this information is the same for all elements that are in the collection. This function does not change the seek position.

ifx_rc_fetch()

The **ifx_rc_fetch()** function retrieves the value of an element that is in a row or collection.

Syntax

```
ifx_rc_fetch(result, rchandle, action, jump)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>result</i>	Data type of the element	Output	Retrieved value
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer
<i>action</i>	SQL_SMALLINT	Input	Location of the element relative to the seek position. The possible values are: ■ SQL_INFX_RC_ABSOLUTE: Element number <i>jump</i> where the first element in the buffer is element number one ■ SQL_INFX_RC_CURRENT: Current element ■ SQL_INFX_RC_FIRST: First element ■ SQL_INFX_RC_LAST: Last element ■ SQL_INFX_RC_NEXT: Next element ■ SQL_INFX_RC_PRIOR: Previous element ■ SQL_INFX_RC_RELATIVE: Element that is <i>jump</i> elements past the current element
<i>jump</i>	SQL_SMALLINT	Input	Offset when <i>action</i> is SQL_INFX_RC_ABSOLUTE or SQL_INFX_RC_RELATIVE

Usage

The **ifx_rc_fetch()** function retrieves the value of the element that is specified by *action* and *jump* and returns the value in *result*. The function sets the seek position to the value that was just fetched.

ifx_rc_free()

The **ifx_rc_free()** function frees a row or collection handle.

Syntax

```
ifx_rc_free(rchandle)
```

Arguments

The function accepts the following argument.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer

Usage

The **ifx_rc_free()** function frees all the resources that are associated with a row or collection handle and frees the handle.

ifx_rc_insert()

The **ifx_rc_insert()** function inserts a new element into a collection.

Syntax

```
ifx_rc_insert(rchandle, value, action, jump)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a collection buffer
<i>value</i>	Data type of the element	Input	Value to insert
<i>action</i>	SQL_SMALLINT	Input	Location of the element relative to the seek position. The possible values are: ■ SQL_INFX_RC_ABSOLUTE: Element number <i>jump</i> where the first element in the buffer is element number one ■ SQL_INFX_RC_CURRENT: Current element ■ SQL_INFX_RC_FIRST: First element ■ SQL_INFX_RC_LAST: Last element ■ SQL_INFX_RC_NEXT: Next element ■ SQL_INFX_RC_PRIOR: Previous element ■ SQL_INFX_RC_RELATIVE: Element that is <i>jump</i> elements past the current element
<i>jump</i>	SQL_SMALLINT	Input	Offset when <i>action</i> is SQL_INFX_RC_ABSOLUTE or SQL_INFX_RC_RELATIVE

Usage

The **ifx_rc_insert()** function inserts a new element into a collection before the location that is specified by *action* and *jump*. The function sets the seek position to the value that was just inserted. It is not possible to insert a new element into a row.

The following table describes the allowable insertion locations for each type of collection.

Type of Collection	Allowable Insertion Locations
List	Anywhere in the buffer
Set or multiset	At the end of the buffer

If the seek position specified by *action* and *jump* exceeds the end of the buffer, **ifx_rc_insert()** appends the new element at the end of the buffer. Likewise, if the seek position specified by *action* and *jump* precedes the beginning of the buffer, **ifx_rc_insert()** inserts the new element at the beginning of the buffer. If *action* specifies an insertion point other than the end for a set or multiset, **ifx_rc_insert()** fails.

For example, if *action* is `SQL_INFX_RC_LAST`, the function inserts the new element before the last element. To append a new element, take one of the following actions:

- Set the seek position to the end of the buffer and set *action* to `SQL_INFX_RC_NEXT`.
- Set *action* to `SQL_INFX_RC_ABSOLUTE` or `SQL_INFX_RC_RELATIVE` and set *jump* to a value that exceeds the end of the buffer.

To insert a new element at the beginning of a buffer, set *action* to `SQL_INFX_RC_FIRST`.

ifx_rc_isnull()

The **ifx_rc_isnull()** function returns a value that indicates whether or not a row or collection is null.

Syntax

```
ifx_rc_isnull(nullflag, rchandle)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>nullflag</i>	SQL_SMALLINT	Output	Flag that indicates whether or not a row or collection is null. The possible values are: ■ TRUE ■ FALSE
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer

Usage

The **ifx_rc_isnull()** function returns a value that indicates whether or not a row or collection is null.

ifx_rc_setnull()

The **ifx_rc_setnull()** function sets a row or collection to null.

Syntax

```
ifx_rc_setnull(rchandle)
```

Arguments

The function accepts the following argument.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer

Usage

The **ifx_rc_setnull()** function sets a row or collection to null. The **ifx_rc_setnull()** function does not set each element within the row or collection to null.

ifx_rc_typespec()

The **ifx_rc_typespec()** function returns the type specification for a row or collection.

Syntax

```
ifx_rc_typespec(typespec, rchandle, flag)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>typespec</i>	SQL_CHAR	Output	Type specification. The format for this value is the same as the type specification syntax for ifx_rc_create() . For more information on ifx_rc_create() arguments, see “Arguments” on page 7-43 .
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer
<i>flag</i>	SQL_SMALLINT	Input	Flag that specifies whether to return the current or original type specification. If this value is TRUE, the function returns the original type specification. Otherwise, the function returns the current type specification.

Usage

The **ifx_rc_typespec()** function returns the type specification for a row or collection.

ifx_rc_update()

The **ifx_rc_update()** function updates the value for an element that is in a row or collection.

Syntax

```
ifx_rc_update(rchandle, value, action, jump)
```

Arguments

The function accepts the following arguments.

Argument	Type	Use	Description
<i>rchandle</i>	HINFX_RC	Input	Handle for a row or collection buffer
<i>value</i>	Data type of the element	Input	Value with which to update the element
<i>action</i>	SQL_SMALLINT	Input	Location of the element relative to the seek position. The possible values are: ■ SQL_INFX_RC_ABSOLUTE: Element number <i>jump</i> where the first element in the buffer is element number one ■ SQL_INFX_RC_CURRENT: Current element ■ SQL_INFX_RC_FIRST: First element ■ SQL_INFX_RC_LAST: Last element ■ SQL_INFX_RC_NEXT: Next element ■ SQL_INFX_RC_PRIOR: Previous element ■ SQL_INFX_RC_RELATIVE: Element that is <i>jump</i> elements past the current element
<i>jump</i>	SQL_SMALLINT	Input	Offset when <i>action</i> is SQL_INFX_RC_ABSOLUTE or SQL_INFX_RC_RELATIVE

Usage

The **ifx_rc_update()** function updates the value for an element that immediately precedes the location that is specified by *action* and *jump*. The function sets the seek position to the value that was just updated.

Improving Application Performance

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In This Chapter

This chapter provides guidelines for designing and coding performance-oriented Informix ODBC Driver applications. These guidelines are based on the following four general performance rules:

- Reduce network traffic as much as possible
- Simplify queries as much as possible
- Optimize the application-to-driver interaction
- Limit disk I/O to improve performance

Connecting to a Data Source

Connection management is extremely important to application performance because the process of connecting to a data source is expensive. To optimize your application, design it to connect only once. Rather than perform multiple connections, use multiple statement handles.

Making One Connection

Some ODBC applications are designed to call information-gathering routines that have no record of connection handles (*hdbc* pointers) that already exist. For example, an application might establish a connection and then call a routine in a separate DLL or shared library that re-attaches and gathers up-front information about the driver to be used later in the application.

To optimize performance, 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.

Using Statement Handles

You can associate multiple statement handles with one connection handle. *Statement handles* provide memory storage for information about SQL statements. You should use statement handles to manage multiple SQL statements instead of connecting and disconnecting several times to execute the SQL statements.

Retrieving Information About a Data Source

Catalog functions are slow compared to all other Informix ODBC Driver functions. **SQLGetTypeInfo** is also a potentially expensive function and is included in this discussion of catalog functions.

Minimizing the Use of Catalog Functions

Although you probably need to use catalog functions to write an ODBC-compliant application, use them sparingly. To return the necessary result set for a single call to a catalog function, a driver might have to perform multiple queries, joins, subqueries, and unions. For this reason, frequent use of catalog functions in an application will likely result in poor performance.

If possible, your application should eliminate the need for multiple executions by caching information that is returned from catalog functions. For example, the application might call **SQLGetTypeInfo** once and cache the elements of the result set on which the application depends. Few applications use all elements of the result set that a catalog function generates, so the cache of information should not be difficult to maintain.

Supplying Non-Null Arguments to Catalog Functions

Because catalog functions are slow, your application should invoke them as efficiently as possible. Passing null arguments to catalog functions can result in the driver generating time-consuming queries and can increase network traffic with unwanted result-set information.

Rather than pass the smallest number of non-null arguments necessary for a catalog function to return success, always supply as many non-null arguments as possible to catalog functions. Any information that the application can send the driver when it calls a catalog function can result in improved performance and reliability.

Consider a call to **SQLTables** in which an application requests information about a table named **Customers**. This call is often coded similarly to the following example:

```
rc = SQLTables (NULL, NULL, NULL, NULL, "Customers", SQL_NTS,  
               NULL);
```

A driver might turn this **SQLTables** call into SQL statements, as in the following example:

```
SELECT...FROM SysTables WHERE TableName = 'Customers'  
      UNION ALL  
SELECT...FROM SysViews WHERE ViewName = 'Customers'  
      UNION ALL  
SELECT...FROM SysSynonyms WHERE SynName = 'Customers'  
      ORDER BY ...
```

Suppose that the result set for this example contains three **Customers** tables: one table that the user owns, one table that sales owns, and one view that management creates. Although it might be obvious that the intent of the application is to use the one that the user owns, it might not be obvious to the user which table to choose. If the application specifies the *OwnerName* argument for the **SQLTables** call, reliability and performance improve, and only one table is returned. (Less network traffic is required to return only one result row, and the data source filters unwanted rows.)

To extend this example, if the application can provide a value for the *TableType* argument, the driver can optimize the SQL statement, as in the following command:

```
SELECT...FROM SysTables WHERE TableName = 'Customers' AND  
      Owner = 'Beth'
```

Determining Table Characteristics

When an application calls **SQLColumns**, the database server must evaluate the query and form a result set to return to the client. When the application makes a dummy query with **SQLDescribeCol**, the database server does not execute the query; it only prepares it. Thus, no results are sent back to the client.

Consider an application that allows the user to choose which columns to select. The following pseudocode fragments and analysis illustrate the performance advantage of **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.
```

Both cases send a query to the database server, but in Case 1, **SQLColumns** must evaluate the query and form a result set that it must send to the client. In Case 2, **SQLDescribeCol** gets the result-column information and the order of the columns within the table without returning the information to the client, thus improving performance.

Avoid using **SQLColumns** to determine characteristics of a table. Instead, use a dummy query with **SQLDescribeCol**.

Retrieving Data

To increase the performance of an application, limit the amount of data retrieved and reduce the call load.

Retrieving Long Data

Retrieving long data (SQL_LONGVARCHAR and SQL_LONGVARBINARY data) across the network is resource intensive and slow. Unless it is absolutely necessary, your application should avoid requesting long data. If the user wants to see long data items, the application can requery the database and specify only the long columns in the SELECT list.

In general, users do not want to see long data. Consequently, a default that does not retrieve long data or binary data is acceptable. If a user does want to see these result items, 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 paying a high performance penalty for intense network traffic.

Although the optimal method is to exclude long data from the SELECT list, some applications do not formulate the select list before they send the query to the driver; that is, some applications use a statement such as the following one:

```
SELECT * FROM table_name...
```

If the SELECT list contains long data, 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.

Using *SQLSetStmtOption* to Reduce the Size of Data Retrieved

When you retrieve long data, your result set can be huge. To reduce the size of the result set data to a manageable level, call **SQLSetStmtOption** with the *SQL_MAX_LENGTH* option.

The *SQL_MAX_LENGTH* option reduces network traffic and improves performance by allowing the driver to communicate to the database server that only *n* bytes of data are pertinent to the client. The database server responds by sending only the first *n* bytes of data for *all* result columns.

A common assumption is that if an application calls **SQLGetData** with a container of size *x*, then the driver retrieves only *x* bytes of information from the database server. On the contrary, because an application can call **SQLGetData** multiple times for any one column, Informix ODBC Driver retrieves long data in large chunks to optimize network use; it then returns the long data to the user upon request. The following code example illustrates the impact on performance:

```
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, the driver is more likely to retrieve 64 kilobytes of information from the database server instead of 1000 bytes. (In terms of network access, one 64 kilobytes retrieval is less expensive than sixty-four 1000-byte retrievals.) Unfortunately, the application might not call **SQLGetData** again; thus, the first and only retrieval of CaseHistory is slowed because 64 kilobytes of data has to be sent across the network.

In the previous example, only one row is returned. The performance impact is significant when, for example, 100 rows are returned in the result set. This example further illustrates how you can limit the size of the data retrieved with the *SQL_MAX_LENGTH* option of **SQLSetStmtOption** to improve performance.

Using **SQLBindCol** to Reduce the Call Load

Another way to improve performance is to retrieve data through bound columns. To reduce the ODBC call load, use **SQLBindCol** instead of **SQLGetData**.

The following pseudocode fragments and analysis illustrate the performance difference that can result from using **SQLBindCol**.

Case 1: *SQLGetData Method*

```
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));
```

Case 2: *SQLBindCol Method*

```
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));
```

Consider a situation in which the query returns 90 result rows. In Case 1, the number of ODBC calls made is greater than 1,890 (20 calls to **SQLGetData** x 90 result rows + 91 calls to **SQLFetch**). In Case 2, the number of ODBC calls made is reduced to about 110 (20 calls to **SQLBindCol** + 91 calls to **SQLFetch**). Clearly, the use of **SQLBindCol** can improve performance.

Another reason to use **SQLBindCol** is that many drivers optimize use of **SQLBindCol** by binding result information directly from the data source into the user's buffer. That is, instead of the driver retrieving information into a container and then copying that information to the user's buffer, the driver simply requests that the information from the database server be placed directly into the user's buffer.

Using **SQLExtendedFetch** Versus **SQLFetch**

To retrieve data, use **SQLExtendedFetch** instead of **SQLFetch**. The ODBC call load decreases, which results in better performance, and the code is less complex, which results in more maintainable code.

Consider the preceding **SQLBindCol** example. The following code example uses **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 that the application makes is reduced from 110 in Case 2 of the previous example to four calls (1 **SQLSetStmtOption** + 1 **SQLExecDirect** + 1 **SQLBindCol** + 1 **SQLExtendedFetch**). The combined use of **SQLBindCol** and **SQLExtendedFetch** reduces the initial call load of more than 1,890 ODBC calls (in [“Case 1: SQLGetData Method” on page 8-9](#)) to only four calls.

Executing Calls with SQLPrepare and SQLExecute Versus SQLExecDirect

Certain functions are more efficient than others at performing specialized tasks.

The combination of **SQLPrepare** and **SQLExecute** is optimized for multiple executions of a statement that most likely uses parameter markers.

SQLExecDirect is optimized for a single execution of an SQL statement. Therefore, for better performance, use **SQLPrepare** and **SQLExecute** for queries that are executed more than once and **SQLExecDirect** for queries that are executed only once.

Unfortunately, more than 75 percent of all ODBC applications use **SQLPrepare** and **SQLExecute** exclusively. The following situation illustrates the pitfall of always coding **SQLPrepare** and **SQLExecute**.

Consider a driver that implements **SQLPrepare** by creating a stored procedure on the database server that contains the prepared statement. Creating a stored procedure has substantial overhead, but the driver assumes that the statement will be executed multiple times. In this case, although stored procedure creation is relatively expensive, execution is minimal because the query is parsed, and optimization paths are stored when the procedure is created. However, for such a driver, if the statement is executed only once, unneeded overhead results.

In general, applications that use **SQLPrepare** and **SQLExecute** for large, single-execution query batches almost certainly cause poor performance.

Similarly, applications that always use **SQLExecDirect** cannot perform as well as those that logically use a combination of **SQLPrepare**, **SQLExecute**, and **SQLExecDirect** sequences.

Using **SQLParamOptions** Versus **SQLPrepare** and Multiple **SQLExecute** Calls

Applications that use **SQLPrepare** and multiple **SQLExecute** calls should use **SQLParamOptions** instead. Passing arrays of parameter values reduces the ODBC call load and greatly reduces network traffic.

The following pseudocode fragments and analysis illustrate the performance difference that can result from using **SQLParamOptions** when you insert large amounts of data.

Case 1: SQLPrepare and Multiple SQLExecute Calls Method

```
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);
```

Case 2: SQLParamOptions Method

```
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
```

In this example, suppose there are 100 rows to insert. In Case 1, **SQLExecute** is called 100 times (resulting in 100 network requests to the database server). In Case 2, which uses an algorithm that uses parameter arrays, the call load is reduced from 100 executions to just two **SQLExecute** calls; network traffic is also reduced considerably. **SQLParamOptions** is ideal for copying data into new tables or loading tables in bulk.

Using 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.

Turning on asynchronous execution does not by itself improve performance. Well-designed applications, however, can take advantage of asynchronous query execution by allowing the user to work on other things while the query is being evaluated on the database 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 database server. Designing for asynchronous execution makes your application appear to run faster by allowing the user to work concurrently on multiple tasks.

By default, an application makes calls to an ODBC driver that then executes statements against the database 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 database server is complete. For statements that take more than a few seconds to complete execution, this control return delay can result in the perception of poor performance.

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 server for execution. The application polls the driver at various intervals at which point the driver itself polls the database server to see if the query has completed execution. If the query is still executing, then the status `SQL_STILL_EXECUTING` is returned to the application. If it has completed, then a status such as `SQL_SUCCESS` is returned, and the application can then begin to fetch records.

Updating Data with Positioned Updates and Deletes

Although positioned updates do not apply to all types of applications, try to use positioned updates and deletes whenever possible. Positioned updates (with `UPDATE WHERE CURRENT OF CURSOR`) allow you to update data by positioning the database cursor to the row to be changed and signaling the driver to change the data. You are not forced to build a complex SQL statement; you simply supply the data to be changed.

Besides making the code more maintainable, positioned updates typically result in improved performance. Because the database server is already positioned on the row (for the `SELECT` statement currently in process), expensive operations to locate the row to be changed are unnecessary. If the row must be located, the database server typically has an internal pointer to the row available (for example, `ROWID`).

To support positioned `UPDATE` and `DELETE` statements with scrollable cursors, the Informix ODBC Driver constructs a new searched `UPDATE` or `DELETE` statement from the original positioned statement. However, the Informix database server cannot update scroll cursors directly. Instead, the Informix ODBC Driver constructs a `WHERE` clause that references each column fetched in the `SELECT` statement referenced in the `WHERE CURRENT OF CURSOR` clause. Values from the rowset data cache of the `SELECT` statement are bound to each value in the constructed `WHERE` clause.

This method of positioning is both slower and perhaps more error prone than using a `WHERE CURRENT OF CURSOR` clause with `FORWARD ONLY` cursors. If the fetched rows do not contain a unique key value, the constructed `WHERE` clause might identify one or many rows, causing many rows to be deleted or updated. Deletion of rows in this manner affects both positioned `UPDATE` and `DELETE` statements, and `SQLSetPos` statements when you use scroll cursors.

Use **SQLSpecialColumns** to determine the optimal set of columns to use in the `WHERE` clause for updating data. Many times pseudocolumns provide the fastest access to the data; you can determine these columns only by using **SQLSpecialColumns**.

Many applications cannot be designed to take advantage of positioned updates and deletes. These applications typically update data by forming a WHERE clause that consists of some subset of the column values that are 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 can result in fairly complex queries.

Consider the following example:

```
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 optimal set of columns (possibly a pseudocolumn) that identifies any given record. Many databases support special columns that are not explicitly user-defined in the table definition but are *hidden* columns of every table (for example, ROWID, TID, and so on). These pseudocolumns almost always provide the fastest access to the data because they typically are pointers to the exact location of the record. Because pseudocolumns are not part of the explicit table definition, they are not returned from **SQLSpecialColumns**. The only way to determine whether pseudocolumns exist is to call **SQLSpecialColumns**.

Consider the previous example, this time using **SQLSpecialColumns**:

```
:
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 pseudocolumns, the result set of **SQLSpecialColumns** consists of the columns of the 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.

Committing Data

Committing data is extremely I/O-intensive and slow. By default, auto-commit is on when a driver connects to a data source. To improve performance, turn auto-commit off.

During a commit, the database server must flush back to disk every data page that contains updated or new data. The database server does not use a sequential write to perform this task. Instead, it uses a searched write to replace existing data that is already in the table. Thus, auto-commit mode is typically detrimental to performance because of the amount of I/O needed to commit *every* operation.

Error Messages

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In This Chapter

This chapter describes the Informix ODBC Driver, Version 3.3, error messages. The chapter provides information on:

- diagnostic SQLSTATE values.
- SQLSTATE values mapped to Informix error messages.
- Informix ODBC Driver error messages mapped to specific SQLSTATE values.

For a detailed description of an error message, see **finderr** or *Informix Error Messages* in Answers OnLine.

Diagnostic SQLSTATE Values

Each Informix ODBC Driver function can return an SQLSTATE value that corresponds to an Informix error code. A function can return additional SQLSTATE values that arise from implementation-specific situations.

SQLException returns SQLSTATE values as defined by the X/Open and SQL Access Group SQL CAE specification (1992).

SQLSTATE values are character strings that consist of a two-character class value followed by a three-character subclass value. A class value of 01 indicates a warning and is accompanied by a return code of `SQL_SUCCESS_WITH_INFO`. Class values other than 01, except for the class `IM`, indicate an error and are accompanied by a return code of `SQL_ERROR`. The class `IM` signifies warnings and errors that derive from the implementation of Informix ODBC Driver. The subclass value 000 in any class is for implementation-defined conditions within the given class. ANSI SQL-92 defines the assignment of class and subclass values.

Mapping SQLSTATE Values to Informix Error Messages

The following table maps SQLSTATE values that an Informix ODBC Driver can return.

A return value of SQL_SUCCESS normally indicates a function has executed successfully, although the SQLSTATE 00000 also indicates success.

SQLSTATE	Error Message	Can be returned from
01000	General warning	All Informix ODBC Driver functions except: SQLAllocEnv SQLError
01002	Disconnect error	SQLDisconnect
01004	Data truncated	SQLBrowseConnect SQLColAttributes SQLDataSources SQLDescribeCol SQLDriverConnect SQLDrivers SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLGetCursorName SQLGetData SQLGetInfo SQLNativeSql SQLPutData SQLSetPos
01006	Privilege not revoked	SQLExecDirect SQLExecute
01S00	Invalid connection string attribute	SQLBrowseConnect SQLDriverConnect
01S01	Error in row	SQLExtendedFetch SQLSetPos

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SQLSTATE	Error Message	Can be returned from
01S02	Option value changed	SQLSetConnectOption SQLSetStmtOption
01S03	No rows updated or deleted	SQLExecDirect SQLExecute SQLSetPos
01S04	More than one row updated or deleted	SQLExecDirect SQLExecute SQLSetPos
07001	Wrong number of parameters	SQLExecDirect SQLExecute
07006	Restricted data type attribute violation	SQLBindParameter SQLExtendedFetch SQLFetch SQLGetData
08001	Unable to connect to data source	SQLBrowseConnect SQLConnect SQLDriverConnect
08002	Connection in use	SQLBrowseConnect SQLConnect SQLDriverConnect SQLSetConnectOption
08003	Connection not open	SQLAllocStmt SQLDisconnect SQLGetConnectOption SQLGetInfo SQLNativeSql SQLSetConnectOption SQLTransact
08004	Data source rejected establishment of connection	SQLBrowseConnect SQLConnect SQLDriverConnect
08007	Connection failure during transaction	SQLTransact

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
08S01	Communication link failure	SQLBrowseConnect SQLColumnPrivileges SQLColumns SQLConnect SQLDriverConnect SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLFreeConnect SQLGetData SQLGetTypeInfo SQLParamData SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLPutData SQLSetConnectOption SQLSetStmtOption SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables
21S01	Insert value list does not match column list	SQLExecDirect SQLPrepare
21S02	Degree of derived table does not match column list	SQLExecDirect SQLPrepare SQLSetPos
22001	String data right truncation	SQLPutData
22003	Numeric value out of range	SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLGetData SQLGetInfo SQLPutData SQLSetPos

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SQLSTATE	Error Message	Can be returned from
22005	Error in assignment	SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLGetData SQLPrepare SQLPutData SQLSetPos
22008	Datetime field overflow	SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLGetData SQLPutData SQLSetPos
22012	Division by zero	SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLGetData
22026	String data, length mismatch	SQLParamData
23000	Integrity constraint violation	SQLExecDirect SQLExecute SQLSetPos

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
24000	Invalid cursor state	SQLColAttributes SQLColumnPrivileges SQLColumns SQLDescribeCol SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLGetData SQLGetStmtOption SQLGetTypeInfo SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLSetCursorName SQLSetPos SQLSetStmtOption SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables
25000	Invalid transaction state	SQLDisconnect
28000	Invalid authorization specification	SQLBrowseConnect SQLConnect SQLDriverConnect
34000	Invalid cursor name	SQLExecDirect SQLPrepare SQLSetCursorName
37000	Syntax error or access violation	SQLExecDirect SQLNativeSql SQLPrepare
3C000	Duplicate cursor name	SQLSetCursorName

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SQLSTATE	Error Message	Can be returned from
40001	Serialization failure	SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch
42000	Syntax error or access violation	SQLExecDirect SQLExecute SQLPrepare SQLSetPos
70100	Operation aborted	SQLCancel
IM001	Driver does not support this function	All ODBC functions except: SQLAllocConnect SQLAllocEnv SQLDataSources SQLDrivers SQLException SQLFreeConnect SQLFreeEnv SQLGetFunctions
IM002	Data source name not found and no default driver specified	SQLBrowseConnect SQLConnect SQLDriverConnect
IM003	Specified driver could not be loaded	SQLBrowseConnect SQLConnect SQLDriverConnect
IM004	Driver SQLAllocEnv failed	SQLBrowseConnect SQLConnect SQLDriverConnect
IM005	Driver SQLAllocConnect failed	SQLBrowseConnect SQLConnect SQLDriverConnect
IM006	Driver SQLSetConnectOption failed	SQLBrowseConnect SQLConnect SQLDriverConnect
IM007	No data source or driver specified; dialog prohibited	SQLDriverConnect

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
IM008	Dialog failed	SQLDriverConnect
IM009	Unable to load translation shared library	SQLBrowseConnect SQLConnect SQLDriverConnect SQLSetConnectOption
IM010	Data source name too long	SQLBrowseConnect SQLDriverConnect
IM011	Driver name too long	SQLBrowseConnect SQLDriverConnect
IM012	DRIVER keyword syntax error	SQLBrowseConnect SQLDriverConnect
IM013	Trace file error	All ODBC functions.
S0001	Base table or view already exists	SQLExecDirect SQLPrepare
S0002	Base table not found	SQLExecDirect SQLPrepare
S0011	Index already exists	SQLExecDirect SQLPrepare
S0012	Index not found	SQLExecDirect SQLPrepare
S0021	Column already exists	SQLExecDirect SQLPrepare
S0022	Column not found	SQLExecDirect SQLPrepare
S0023	No default for column	SQLSetPos
S1000	General error	All ODBC functions except: SQLAllocEnv SQLError

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SQLSTATE	Error Message	Can be returned from
S1001	Memory allocation failure	All ODBC functions except: SQLAllocEnv SQLError SQLFreeConnect SQLFreeEnv
S1002	Invalid column number	SQLBindCol SQLColAttributes SQLDescribeCol SQLExtendedFetch SQLFetch SQLGetData
S1003	Program type out of range	SQLBindCol SQLBindParameter SQLGetData
S1004	SQL data type out of range	SQLBindParameter SQLGetTypeInfo

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SQLSTATE	Error Message	Can be returned from
S1008	Operation canceled	All ODBC functions that can be processed asynchronously: SQLColAttributes SQLColumnPrivileges SQLColumns SQLDescribeCol SQLDescribeParam SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLGetData SQLGetTypeInfo SQLMoreResults SQLNumParams SQLNumResultCols SQLParamData SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLPutData SQLSetPos SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables

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SQLSTATE	Error Message	Can be returned from
S1009	Invalid argument value	SQLAllocConnect SQLAllocStmt SQLBindCol SQLBindParameter SQLExecDirect SQLForeignKeys SQLGetData SQLGetInfo SQLNativeSql SQLPrepare SQLPutData SQLSetConnectOption SQLSetCursorName SQLSetPos SQLSetStmtOption

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
S1010	Function sequence error	SQLBindCol SQLBindParameter SQLColAttributes SQLColumnPrivileges SQLColumns SQLDescribeCol SQLDisconnect SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLFreeConnect SQLFreeEnv SQLFreeStmt SQLGetConnectOption SQLGetCursorName SQLGetData SQLGetFunctions SQLGetStmtOption SQLGetTypeInfo SQLMoreResults SQLNumParams SQLNumResultCols SQLParamData SQLParamOptions SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLPutData SQLRowCount SQLSetConnectOption SQLSetCursorName SQLSetPos SQLSetScrollOptions SQLSetStmtOption SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables SQLTransact

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
S1011	Operation invalid at this time	SQLGetStmtOption SQLSetConnectOption SQLSetStmtOption
S1012	Invalid transaction operation code specified	SQLTransact
S1015	No cursor name available	SQLGetCursorName
S1090	Invalid string or buffer length	SQLBindCol SQLBindParameter SQLBrowseConnect SQLColAttributes SQLColumnPrivileges SQLColumns SQLConnect SQLDataSources SQLDescribeCol SQLDriverConnect SQLDrivers SQLExecDirect SQLExecute SQLForeignKeys SQLGetCursorName SQLGetData SQLGetInfo SQLNativeSql SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLPutData SQLSetCursorName SQLSetPos SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables
S1091	Descriptor type out of range	SQLColAttributes

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Mapping SQLSTATE Values to Informix Error Messages

SQLSTATE	Error Message	Can be returned from
S1092	Option type out of range	SQLFreeStmt SQLGetConnectOption SQLGetStmtOption SQLSetConnectOption SQLSetStmtOption
S1093	Invalid parameter number	SQLBindParameter
S1094	Invalid scale value	SQLBindParameter
S1095	Function type out of range	SQLGetFunctions
S1096	Information type out of range	SQLGetInfo
S1097	Column type out of range	SQLSpecialColumns
S1098	Scope type out of range	SQLSpecialColumns
S1099	Nullable type out of range	SQLSpecialColumns
S1100	Uniqueness option type out of range	SQLStatistics
S1101	Accuracy option type out of range	SQLStatistics
S1103	Direction option out of range	SQLDataSources SQLDrivers
S1104	Invalid precision value	SQLBindParameter
S1105	Invalid parameter type	SQLBindParameter
S1106	Fetch type out of range	SQLExtendedFetch
S1107	Row value out of range	SQLExtendedFetch SQLParamOptions SQLSetPos SQLSetScrollOptions
S1108	Concurrency option out of range	SQLSetScrollOptions
S1109	Invalid cursor position	SQLExecute SQLExecDirect SQLGetData SQLGetStmtOption SQLSetPos

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SQLSTATE	Error Message	Can be returned from
S1110	Invalid driver completion	SQLDriverConnect
S1111	Invalid bookmark value	SQLExtendedFetch
S1C00	Driver not capable	SQLBindCol SQLBindParameter SQLColAttributes SQLColumnPrivileges SQLColumns SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLGetConnectOption SQLGetData SQLGetInfo SQLGetStmtOption SQLGetTypeInfo SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLSetConnectOption SQLSetPos SQLSetScrollOptions SQLSetStmtOption SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables SQLTransact

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SQLSTATE	Error Message	Can be returned from
S1T00	Time-out expired	SQLBrowseConnect SQLColAttributes SQLColumnPrivileges SQLColumns SQLConnect SQLDescribeCol SQLDriverConnect SQLExecDirect SQLExecute SQLExtendedFetch SQLFetch SQLForeignKeys SQLGetData SQLGetInfo SQLGetTypeInfo SQLMoreResults SQLNumParams SQLNumResultCols SQLParamData SQLPrepare SQLPrimaryKeys SQLProcedureColumns SQLProcedures SQLPutData SQLSetPos SQLSpecialColumns SQLStatistics SQLTablePrivileges SQLTables

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Mapping Informix Error Messages to SQLSTATE Values

The rest of this chapter describes diagnostic SQLSTATE values for Informix ODBC Driver functions. The return code for each SQLSTATE value is SQL_ERROR unless a description indicates otherwise. When a function returns SQL_SUCCESS_WITH_INFO or SQL_ERROR, you can call **SQLError** to get the SQLSTATE value.

SQLAllocConnect

The following table describes the SQLSTATE and error values for **SQLAllocConnect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value

SQLAllocEnv

SQLAllocEnv allocates memory for an environment handle and initializes the driver call level interface for application use. An application must call **SQLAllocEnv** before it calls any other driver function.

A driver cannot return SQLSTATE values directly after the call to **SQLAllocEnv** because no valid handle exists with which to call **SQLError**.

Two levels of **SQLAllocEnv** functions exist, one within the driver manager (if you are using one) and one within the driver. The driver manager does not call the driver-level function until the application calls **SQLConnect**, **SQLBrowseConnect**, or **SQLDriverConnect**. If an error occurs in the driver-level **SQLAllocEnv** function, the driver manager-level **SQLConnect**, **SQLBrowseConnect**, or **SQLDriverConnect** function returns SQL_ERROR. A subsequent call to **SQLError** with *henv*, SQL_NULL_HDBC, and SQL_NULL_HSTMT returns SQLSTATE IM004 (the driver **SQLAllocEnv** function failed), followed by one of the following errors from the driver:

- SQLSTATE S1000 (General error)
- An Informix ODBC Driver SQLSTATE value, which ranges from S1000 to S19ZZ.

For example, SQLSTATE S1001 (Memory-allocation failure) indicates that the call from the driver manager to the driver-level **SQLAllocEnv** returned SQL_ERROR, and the *henv* from the driver manager was set to SQL_NULL_HENV.

Core

SQLAllocStmt

SQLAllocStmt allocates memory for a statement handle and associates the statement handle with the connection that *hdbc* specifies.

An application must call **SQLAllocStmt** before it submits SQL statements.

The following table describes the SQLSTATE and error values for **SQLAllocStmt**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08003	-11017	Connection not open
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
08S01	-11301	A protocol error has been detected. Current connection is closed.

SQLBindCol

SQLBindCol assigns the storage and Informix ODBC Driver C data type for a column in a result set, as follows:

- A storage buffer that receives the contents of a column of data
- The length of the storage buffer
- A storage location that receives the actual length of the column of data returned by the fetch operation
- Data type conversion from the Informix SQL data type to the Informix ODBC Driver C data type

The following table describes the SQLSTATE and error values for **SQLBindCol**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1003	-11063	Program type out of range
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable



Important: An application can call **SQLBindCol** to bind a column to a new storage location, regardless of whether data has already been fetched. The new binding replaces the old binding for bookmark columns as well as other bound columns. Note that the new binding does not apply to data already fetched—it takes effect the next time **SQLFetch**, **SQLExtendedFetch**, or **SQLSetPos** is called.

Level 1

SQLBindParameter

SQLBindParameter binds a buffer to a parameter marker in an SQL statement.

The following table describes the SQLSTATE and error values for **SQLBindParameter**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
07006	-11013	Restricted data type attribute violation
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1003	-11063	Program type out of range
S1004	-11064	SQL data type out of range
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1093	-11074	Invalid parameter number
S1094	-11075	Invalid scale value
S1104	-11084	Invalid precision value
S1105	-11085	Invalid parameter type
S1C00	-11092	Driver not capable

Level 2

SQLBrowseConnect

SQLBrowseConnect supports an iterative method of discovering and enumerating the attributes and attribute values required to connect to a data source. Each call to **SQLBrowseConnect** returns successive levels of attributes and attribute values. When all levels are enumerated, a connection to the data source is completed, and **SQLBrowseConnect** returns a complete connection string. A return code of SQL_SUCCESS_WITH_INFO or SQL_SUCCESS indicates that all connection information was specified, and the application is now connected to the data source.

The following table describes the SQLSTATE and error values for the function.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
01S00	-11005	Invalid connection string attribute
08001	-11015	Unable to connect to data source
08002	-11016	Connection in use
08S01	-11020	Communication-link failure
28000	-11033	Invalid authorization specification
IM002	-11041	Data source not found and no default driver specified
IM003	-11042	Specified driver could not be loaded
IM004	-11043	Driver SQLAllocEnv failed
IM005	-11044	Driver SQLAllocConnect failed
IM006	-11045	Driver SQLSetConnectOption failed
IM009	-11048	Unable to load translation-shared library
IM010	-11049	Data-source name too long
IM011	-11050	Driver name too long

(1 of 2)

SQLSTATE	Error Value	Error Message
IM012	-11051	DRIVER keyword syntax error
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1090	-11071	Invalid string or buffer length
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11303	Input connection string too large
S1000	-11317	Invalid CONNECTDATABASE value specified
S1000	-11318	Invalid VMBCHARLENEXACT value specified
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(2 of 2)

SQLCancel

SQLCancel cancels the processing on an *hstmt* or a query.

The following table describes the SQLSTATE and error values for the function.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01S05	-11010	Cancel treated as FreeStmt/ Close.
70100	-11039	Operation aborted
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
08S01	-11301	A protocol error has been detected. Current connection is closed.

SQLColAttributes

SQLColAttributes returns descriptor information for a column in a result set; it cannot be used to return information about the bookmark column (column 0). Descriptor information is returned as a character string, a 32-bit descriptor-dependent value, or an integer value.

The following table describes the SQLSTATE and error values for **SQLColAttributes**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1091	-11072	Descriptor type out of range
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired

SQLColAttributes can return any SQLSTATE that can be returned by **SQLPrepare** or **SQLExecute** when it is called after **SQLPrepare** and before **SQLExecute**, depending on when the data source evaluates the SQL statement associated with the *hstmt*.

Level 2

SQLColumnPrivileges

SQLColumnPrivileges returns a list of columns and associated privileges for the specified table. The driver returns the information as a result set on the specified *hstmt*.

The following table describes the SQLSTATE and error values for **SQLColumnPrivileges**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Level 1

SQLColumns

SQLColumns returns the list of column names in specified tables. The driver returns this information as a result set on the specified *hstmt*.

The following table describes the SQLSTATE and error values for **SQLColumns**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

SQLConnect

SQLConnect loads a driver and establishes a connection to a data source. The connection handle references where all information about the connection, including status, transaction state, and error information is stored.

The following table describes the SQLSTATE and error values for **SQLConnect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08001	-11015	Unable to connect to data source
08002	-11016	Connection in use
08S01	-11020	Communication-link failure
28000	-11033	Invalid authorization specification
IM002	-11041	Data source not found and no default driver specified
IM003	-11042	Specified driver could not be loaded
IM004	-11043	Driver SQLAllocEnv failed
IM005	-11044	Driver SQLAllocConnect failed
IM006	-11045	Driver SQLSetConnectOption failed
IM009	-11048	Unable to load translation shared library
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1090	-11071	Invalid string or buffer length
S1T00	-11094	Time-out expired

(1 of 2)

SQLSTATE	Error Value	Error Message
S1000	-11302	Insufficient connection information was supplied.
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(2 of 2)

Level 2

SQLDataSources

SQLDataSources lists data-source names.

The following table describes the SQLSTATE and error values for **SQLDataSources**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1090	-11071	Invalid string or buffer length
S1103	-11083	Direction option out of range

SQLDescribeCol

SQLDescribeCol returns the result descriptor (column name, type, precision, scale, and whether or not it can have a NULL value) for one column in the result set; it cannot be used to return information about the bookmark column (column 0).

The following table describes the SQLSTATE and error values for **SQLDescribeCol**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1T00	-11094	Time-out expired

SQLDescribeCol can return any SQLSTATE that **SQLPrepare** or **SQLExecute** returns when **SQLDescribeCol** is called after **SQLPrepare** and before **SQLExecute**, depending on when the data source evaluates the SQL statement associated with the *hstmt*.

SQLDisconnect

SQLDisconnect closes the connection associated with a specific connection handle.

The following table describes the SQLSTATE and error values for **SQLDisconnect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01002	-11002	Disconnect error
08003	-11017	Connection not open
25000	-11032	Invalid transaction state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
08S01	-11301	A protocol error has been detected. Current connection is closed.

Usage

If an application calls **SQLDisconnect** after **SQLBrowseConnect** returns SQL_NEED_DATA and before it returns a different return code, the driver cancels the connection-browsing process and returns the *hdbc* to an unconnected state.

If an application calls **SQLDisconnect** while an incomplete transaction is associated with the connection handle, the driver returns SQLSTATE 25000 (Invalid transaction state), indicating that the transaction is unchanged and the connection is open. An incomplete transaction is one that was not committed or rolled back with **SQLTransact**.

If an application calls **SQLDisconnect** before it frees every *hstmt* associated with the connection, the driver frees each remaining *hstmt* after it successfully disconnects from the data source. However, if one or more of the *hstmts* associated with the connection are still executing asynchronously, **SQLDisconnect** returns SQL_ERROR with a SQLSTATE value of S1010 (Function sequence error).

Level 1

SQLDriverConnect

SQLDriverConnect is an alternative to **SQLConnect**. It supports data sources that require more connection information than the three arguments in **SQLConnect** dialog boxes to prompt the user for all connection information and data sources that are not defined data-source names.

SQLDriverConnect provides the following connection options:

- You can establish a connection using a connection string that contains the data-source name, one or more user IDs, one or more passwords, and other information that the data source requires.
- You can establish a connection using a partial connection string or no additional information; in this case, Informix ODBC Driver can prompt the user for connection information.

Once a connection is established, **SQLDriverConnect** returns the completed connection string. The application can use this string for subsequent connection requests.

The following table describes the SQLSTATE and error values for **SQLDriverConnect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
01S00	-11005	Invalid connection string attribute
08001	-11015	Unable to connect to data source
08002	-11016	Connection in use
08S01	-11020	Communication-link failure
28000	-11033	Invalid authorization specification
IM002	-11041	Data source not found and no default driver specified
IM003	-11042	Specified driver could not be loaded

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SQLSTATE	Error Value	Error Message
IM004	-11043	Driver SQLAllocEnv failed
IM005	-11044	Driver SQLAllocConnect failed
IM006	-11045	Driver SQLSetConnectOption failed
IM007	-11046	No data source or driver specified; dialog prohibited
IM008	-11047	Dialog failed
IM009	-11048	Unable to load translation shared library
IM010	-11049	Data-source name too long
IM011	-11050	Driver name too long
IM012	-11051	DRIVER keyword syntax error
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1090	-11071	Invalid string or buffer length
S1110	-11090	Invalid driver completion
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11302	Insufficient connection information was supplied.
S1000	-11303	Input connection string too large
S1000	-11317	Invalid CONNECTDATABASE value specified
S1000	-11318	Invalid VMBCHARLENEXACT value specified
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

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SQLDrivers

SQLDrivers lists driver descriptions and driver-attribute keywords.

The following table describes the SQLSTATE and error values for **SQLDrivers**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1090	-11071	Invalid string or buffer length
S1103	-11083	Direction option out of range

SQLError

SQLError returns error or status information.

SQLError does not post error values for itself. **SQLError** returns `SQL_NO_DATA_FOUND` when it cannot retrieve any error information (in which case *sqlstate* equals 00000). If **SQLError** cannot access error values for any reason that would normally return `SQL_ERROR`, **SQLError** returns `SQL_ERROR` but does not post any error values. If the buffer for the error message is too short, **SQLError** returns `SQL_SUCCESS_WITH_INFO` but still does not return a `SQLSTATE` value for **SQLError**.

To determine that a truncation occurred in the error message, an application can compare *cbErrorMsgMax* to the actual length of the message text written to *pcbErrorMsg*.

SQLExecDirect

SQLExecDirect executes a preparable statement, using the current values of the parameter-marker variables if any parameters exist in the statement.

SQLExecDirect is the fastest way to submit an SQL statement for one-time execution.

The following table describes the SQLSTATE and error values for **SQLExecDirect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
01006	-11004	Privilege not revoked
01S03	-11008	No rows updated or deleted
01S04	-11009	More than one row updated or deleted
07001	-11012	Wrong number of parameters
07S01	-11014	Invalid use of default parameter.
08S01	-11020	Communication-link failure
21S01	-11021	Insert value list does not match column list
21S02	-11022	Degree of derived table does not match column list
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime field overflow
22012	-11028	Division by zero
23000	-11030	Integrity-constraint violation
24000	-11031	Invalid cursor state
34000	-11034	Invalid cursor name

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SQLSTATE	Error Value	Error Message
37000	-11035	Syntax error or access violation
40001	-11037	Serialization failure
42000	-11038	Syntax error or access violation
S0001	-11053	Base table or view already exists
S0002	-11054	Table or view not found
S0011	-11055	Index already exists
S0012	-11056	Index not found
S0021	-11057	Column already exists
S0022	-11058	Column not found
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1109	-11089	Invalid cursor position
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.

(2 of 3)

SQLSTATE	Error Value	Error Message
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(3 of 3)

SQLExecute

SQLExecute executes a prepared statement, using the current values of the parameter-marker variables if any parameter markers exist in the statement.

The following table describes the SQLSTATE and error values for **SQLExecute**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
01006	-11004	Privilege not revoked
01S03	-11008	No rows updated or deleted
01S04	-11009	More than one row updated or deleted
07001	-11012	Wrong number of parameters
07S01	-11014	Invalid use of default parameter.
08S01	-11020	Communication-link failure
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime field overflow
22012	-11028	Division by zero
23000	-11030	Integrity constraint violation
24000	-11031	Invalid cursor state
40001	-11037	Serialization failure
42000	-11038	Syntax error or access violation
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled

SQLSTATE	Error Value	Error Message
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1109	-11089	Invalid cursor position
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(2 of 2)

SQLExecute can return any SQLSTATE that **SQLPrepare** can return based on when the data source evaluates the SQL statement associated with the *hstmt*.

SQLExtendedFetch

SQLExtendedFetch extends the functionality of **SQLFetch** in the following ways:

- It returns row-set data (one or more rows), in the form of an array, for each bound column.
- It scrolls through the result set according to the setting of a scroll-type argument.

SQLExtendedFetch works with **SQLSetStmtOption**.

To fetch one row of data at a time in a forward direction, an application should call **SQLFetch**.

For more information about scrolling through result sets, see [“Using Block and Scrollable Cursors” on page 8-9](#).

The following table describes the SQLSTATE and error values for **SQLExtendedFetch**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
01S01	-11006	Error in row
07006	-11013	Restricted data type attribute violation
08S01	-11020	Communication-link failure
22002	-11024	Indicator value required but not supplied
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime field overflow
22012	-11028	Division by zero
24000	-11031	Invalid cursor state

(1 of 2)

SQLSTATE	Error Value	Error Message
40001	-11037	Serialization failure
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1106	-11086	Fetch type out of range
S1107	-11087	Row value out of range
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11307	In SQLExtendedFetch , only SQL_FETCH_NEXT is supported for SQL_SCROLL_FORWARD_ONLY cursors

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If an error occurs that pertains to the entire row set, such as SQLSTATE S1T00 (Time-out expired), the driver returns SQL_ERROR and the appropriate SQLSTATE. The contents of the row set buffers are undefined, and the cursor position is unchanged.

If an error occurs that pertains to a single row, the driver performs the following actions:

- Sets the element in the *rgfRowStatus* array for the row to SQL_ROW_ERROR
- Posts SQLSTATE 01S01 (Error in row) in the error queue
- Posts zero or more additional SQLSTATE values for the error after SQLSTATE 01S01 (Error in row) in the error queue

After the driver processes the error or warning, it continues the operation for the remaining rows in the row set and returns `SQL_SUCCESS_WITH_INFO`. Thus, for each error that pertains to a single row, the error queue contains `SQLSTATE 01S01` (Error in row) followed by zero or more additional `SQLSTATES`.

After the driver processes the error, it fetches the remaining rows in the row set and returns `SQL_SUCCESS_WITH_INFO`. Thus, for each row that returns an error, the error queue contains `SQLSTATE 01S01` (Error in row) followed by zero or more additional `SQLSTATE` values.

If the row set contains rows that are already fetched, the driver is not required to return `SQLSTATE` values for errors that occurred when the rows were first fetched. However, it is required to return `SQLSTATE 01S01` (Error in row) for each row in which an error originally occurred and to return `SQL_SUCCESS_WITH_INFO`. For example, a static cursor that maintains a cache might cache row-status information (so that it can determine which rows contain errors) but might not cache the `SQLSTATE` associated with those errors.

Error rows do not affect relative cursor movements. For example, suppose the result set size is 100, and the row-set size is 10. If the current row set is rows 11 through 20 and the element in the *rgfRowStatus* array for row 11 is `SQL_ROW_ERROR`, calling **SQLExtendedFetch** with the `SQL_FETCH_NEXT` fetch type still returns rows 21 through 30.

If the driver returns any warnings, such as `SQLSTATE 01004` (Data truncated), it returns warnings that apply to the entire row set or to unknown rows in the row set before it returns error information that applies to specific rows. It returns warnings for specific rows along with any other error information about those rows.

SQLFetch

SQLFetch fetches a row of data from a result set. The driver returns data for all columns that were bound to storage locations with **SQLBindCol**.

The following table describes the SQLSTATE and error values for **SQLFetch**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
07006	-11013	Restricted data-type attribute violation
08S01	-11020	Communication-link failure
22002	-11024	Indicator value required but not supplied
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime field overflow
22012	-11028	Division by zero
24000	-11031	Invalid cursor state
40001	-11037	Serialization failure
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired

Level 2

SQLForeignKeys

SQLForeignKeys can return either of the following items:

- A list of foreign keys in the specified table (columns in the specified table that refer to primary keys in other tables)
- A list of foreign keys in other tables that refer to the primary key in the specified table

The driver returns each list as a result set on the specified *hstmt*.

The following table describes the SQLSTATE and error values for SQLForeignKeys.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication link failure
24000	-11031	Invalid cursor state
IM001	-11040	Driver does not support this function
S1000	-11060	General error
S1001	-11061	Memory allocation failure
S1008	-11065	Operation canceled
S1009	-11066	Invalid argument value
S1010	-11067	Function sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Timeout expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.

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SQLSTATE	Error Value	Error Message
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver
S1000	-11323	The statement contains an escape clause not supported by this database driver

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Core

SQLFreeConnect

SQLFreeConnect releases a connection handle and frees all memory associated with the handle.

The following table describes the SQLSTATE and error values for **SQLFreeConnect**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
S1000	-11060	General error
S1010	-11067	Function-sequence error

SQLFreeEnv

SQLFreeEnv frees the environment handle and releases all memory associated with the environment handle.

The following table describes the SQLSTATE and error values for **SQLFreeEnv**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1010	-11067	Function-sequence error

SQLFreeStmt

SQLFreeStmt stops the processing that is associated with a specific *hstmt*, closes any open cursors that are associated with the *hstmt*, discards pending results, and, optionally, frees all resources associated with the statement handle.

The following table describes the SQLSTATE and error values for **SQLFreeStmt**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1092	-11073	Option type out of range

Level 1

SQLGetConnectOption

SQLGetConnectOption returns the current setting of a connection option.

The following table describes the SQLSTATE and error values for **SQLGetConnectOption**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08003	-11017	Connection not open
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1092	-11073	Option type out of range
S1C00	-11092	Driver not capable

Core

SQLGetCursorName

SQLGetCursorName returns the cursor name associated with a specified *hstmt*.

The following table describes the SQLSTATE and error values for **SQLGetCursorName**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1015	-11070	No cursor name available
S1090	-11071	Invalid string or buffer length

Level 1

SQLGetData

SQLGetData returns result data for a single unbound column in the current row. The application must call **SQLFetch** or **SQLExtendedFetch** and (optionally) **SQLSetPos** to position the cursor on a row of data before it calls **SQLGetData**. It is possible to use **SQLBindCol** for some columns and use **SQLGetData** for others within the same row. This function can be used to retrieve character or binary data values in parts from a column with a character, binary, or data source-specific data type (for example, data from SQL_LONGVARBINARY or SQL_LONGVARCHAR columns).

The following table describes the SQLSTATE and error values for **SQLGetData**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
07006	-11013	Restricted data- type attribute violation
08S01	-11020	Communication-link failure
22002	-11024	Indicator value required but not supplied
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime-field overflow
22012	-11028	Division by zero
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1002	-11062	Invalid column number
S1003	-11063	Program type out of range
S1008	-11065	Operation canceled

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SQLSTATE	Error Value	Error Message
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1109	-11089	Invalid cursor position
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.

(2 of 2)

Level 1

SQLGetFunctions

SQLGetFunctions returns information about whether the driver supports a specific function.

The following table describes the SQLSTATE and error values for **SQLGetFunctions**.

SQLSTATE	Error Value	Error Message
01000	-1101	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1095	-11076	Function type out of range

Level 1

SQLGetInfo

SQLGetInfo returns general information about the driver and data source associated with an *hdbc*.

The following table describes the SQLSTATE and error values for **SQLGetInfo**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
08003	-11017	Connection not open
22003	-11025	Numeric value out of range
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
S1090	-11071	Invalid string or buffer length
S1096	-11077	Information type out of range
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.

Level 1

SQLGetStmtOption

SQLGetStmtOption returns the current setting of a statement option.

The following table describes the SQLSTATE and error values for **SQLGetStmtOption**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1011	-11068	Operation invalid at this time
S1092	-11073	Option type out of range
S1109	-11089	Invalid cursor position
S1C00	-11092	Driver not capable

Level 1

SQLGetTypeInfo

SQLGetTypeInfo returns information about data types that the data source supports. The driver returns the information in the form of an SQL result set.

The following table describes the SQLSTATE and error values for **SQLGetTypeInfo**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1004	-11063	SQL data type out of range
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11305	SQLGetTypeInfo supported for FORWARD_ONLY cursors
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Level 2

SQLMoreResults

SQLMoreResults determines whether more results are available on an *hstmt* that contains SELECT, UPDATE, INSERT, or DELETE statements and, if so, initializes processing for those results.

The following table describes the SQLSTATE and error values for **SQLMoreResults**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.

SQLNativeSql

SQLNativeSql returns the SQL string that the driver translates.

The following table describes the SQLSTATE and error values for **SQLNativeSql**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
08003	-11017	Connection not open
37000	-11035	Syntax error or access violation
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
S1090	-11071	Invalid string or buffer length
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Usage

The following example shows what **SQLNativeSql** might return for an input SQL string that contains the scalar function LENGTH:

```
SELECT {fn LENGTH(NAME)} FROM EMPLOYEE
```

An Informix Dynamic Server driver might return the following translated SQL string:

```
SELECT length(NAME) FROM EMPLOYEE
```



Level 2

SQLNumParams

SQLNumParams returns the number of parameters in an SQL statement.

The following table describes the SQLSTATE and error values for **SQLNumParams**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1T00	-11094	Time-out expired

Core

SQLNumResultCols

SQLNumResultCols returns the number of columns in a result set.

The following table describes the SQLSTATE and error values for **SQLNumResultCols**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1T00	-11094	Time-out expired

SQLNumResultCols can return any SQLSTATE that **SQLPrepare** or **SQLExecute** can return when **SQLNumResultCols** is called after **SQLPrepare** and before **SQLExecute** is called, depending on when the data source evaluates the SQL statement associated with the *hstmt*.

Level 1

SQLParamData

SQLParamData is used with **SQLPutData** to supply parameter data when a statement executes.

The following table describes the SQLSTATE and error values for **SQLParamData**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
22026	-11029	String data, length mismatch
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.

If **SQLParamData** is called while sending data for a parameter in an SQL statement, it can return any SQLSTATE that can be returned by the function that was called to execute the statement (**SQLExecute** or **SQLExecDirect**). If it is called while sending data for a column being updated or added with **SQLSetPos**, it can return any SQLSTATE that can be returned by **SQLSetPos**.

If **SQLParamData** is called while sending data for a parameter in an SQL statement, it can return any SQLSTATE that can be returned by the function that was called to execute the statement (**SQLExecute** or **SQLExecDirect**).

Core

Level 2

SQLParamOptions

SQLParamOptions allows an application to specify multiple values for the set of parameters assigned by **SQLBindParameter**. The ability to specify multiple values for a set of parameters is useful for bulk inserts and other work that requires the data source to process the same SQL statement multiple times with various parameter values. For example, an application can specify three sets of values for the set of parameters associated with an INSERT statement, and then execute the INSERT statement once to perform the three insert operations.

The following table lists the SQLSTATE values commonly returned by **SQLParamOptions** and explains each one in the context of this function; the notation “(DM)” precedes the description of each SQLSTATE returned by the driver manager. The return code associated with each SQLSTATE value is SQL_ERROR unless noted otherwise.

SQLSTATE	Error Value	Error Message
01000		General warning
S1000		General error
S1001		Memory-allocation failure
S1010		Function-sequence error
S1107		Row value out of range

SQLPrepare

SQLPrepare prepares an SQL string for execution.

The following table describes the SQLSTATE and error values for **SQLPrepare**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
21S01	-11021	Insert value list does not match column list.
21S02	-11022	Degree of derived table does not match column list.
22005	-11026	Error in assignment
24000	-11031	Invalid cursor state
34000	-11034	Invalid cursor name
37000	-11035	Syntax error or access violation
42000	-11038	Syntax error or access violation
S0001	-11053	Base table or view already exists
S0002	-11054	Base table not found
S0011	-11055	Index already exists.
S0012	-11056	Index not found
S0021	-11057	Column already exists.
S0022	-11058	Column not found
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error

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SQLSTATE	Error Value	Error Message
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(2 of 2)

SQLPrimaryKeys

SQLPrimaryKeys returns the column names that comprise the primary key for a table. The driver returns the information as a result set. This function does not support returning primary keys from multiple tables in a single call.

The following table describes the SQLSTATE and error values for **SQLPrimaryKeys**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Level 2

SQLProcedureColumns

SQLProcedureColumns returns the list of input and output parameters, as well as the columns that make up the result set for the specified procedures. The driver returns the information as a result set on the specified *hstmt*.

The following table describes the SQLSTATE and error values for **SQLProcedureColumns**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication link failure
24000	-11031	Invalid cursor state
IM001	-11040	Driver does not support this function
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

SQLProcedures

SQLProcedures returns the list of procedure names stored in a specific data source. *Procedure* is a generic term used to describe an *executable object*, or a named entity that can be invoked using input and output parameters, and which can return result sets similar to the results that SELECT statements return.

The following table describes the SQLSTATE and error values for **SQLProcedures**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Level 1

SQLPutData

SQLPutData allows an application to send data for a parameter or column to the driver at statement execution time. This function can send character or binary data values in parts to a column with a character, binary, or data-source-specific data type (for example, parameters of SQL_LONGVARIABLE or SQL_LONGVARIABLE).

The following table describes the SQLSTATE and error values for **SQLPutData**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01004	-11003	Data truncated
07S01	-11014	Invalid use of default parameter.
08S01	-11020	Communication-link failure
22001	-11023	String data right truncation
22003	-11025	Numeric value out of range
22005	-11026	Error in assignment
22008	-11027	Datetime-field overflow
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1T00	-11094	Time-out expired



Important: An application can use **SQLPutData** to send sections of character C data to a column with a character, binary, or data source-specific data type or to send binary C data to a column with a character, binary, or data source-specific data type. If **SQLPutData** is called more than once under any other conditions, it returns `SQL_ERROR` and `SQLSTATE 22003` (Numeric value out of range).

Core

SQLRowCount

SQLRowCount returns the number of rows affected by an UPDATE, INSERT, or DELETE statement or by an SQL_UPDATE, SQL_ADD, or SQL_DELETE operation in **SQLSetPos**.

The following table describes the SQLSTATE and error values for **SQLRowCount**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error

Level 1

SQLSetConnectOption

SQLSetConnectOption sets options that govern aspects of connections.

The following table describes the SQLSTATE and error values for **SQLSetConnectOption**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01S02	-11007	Option value changed
08002	-11016	Connection in use
08003	-11017	Connection not open
08S01	-11020	Communication-link failure
IM009	-11048	Unable to load translation shared library
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1011	-11068	Operation invalid at this time
S1092	-11073	Option type out of range
S1C00	-11092	Driver not capable
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

When *fOption* is a statement option, **SQLSetConnectOption** can return any SQLSTATE that **SQLSetStmtOption** returns.

Core

SQLSetCursorName

SQLSetCursorName associates a cursor name with an active *hstmt*. If an application does not call **SQLSetCursorName**, the driver generates cursor names as needed for SQL statement processing.

The following table describes the SQLSTATE and error values for **SQLSetCursorName**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
24000	-11031	Invalid cursor state
34000	-11034	Invalid cursor name
3C000	-11036	Duplicate cursor name
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length

Level 1

SQLSetStmtOption

SQLSetStmtOption sets options that are related to an *hstmt*. To set an option for all the statements associated with a specific *hdbc*, an application can call **SQLSetConnectOption**.

The following table describes the SQLSTATE and error values for **SQLSetStmtOption**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
01S02	-11007	Option value changed
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1009	-11066	Invalid argument value
S1010	-11067	Function-sequence error
S1011	-11068	Operation invalid at this time
S1092	-11073	Option value out of range
S1C00	-11092	Driver not capable

Level 1

SQLSpecialColumns

SQLSpecialColumns retrieves the following information about columns within a specified table:

- The optimal set of columns that uniquely identifies a row in the table
- Columns that are automatically updated when any value in the row is updated by a transaction

The following table describes the SQLSTATE and error values for **SQLSpecialColumns**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory- allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1097	-11078	Column type out of range
S1098	-11079	Scope type out of range
S1099	-11080	Nullable type out of range
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported

(1 of 2)

SQLSTATE	Error Value	Error Message
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

(2 of 2)

SQLStatistics

SQLStatistics retrieves a list of statistics about a single table and the indexes associated with the table. The driver returns this information as a result set.

The following table describes the SQLSTATE and error values for **SQLStatistics**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory- allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1100	-11081	Uniqueness option type out of range
S1101	-11082	Accuracy option type out of range
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

Level 2

SQLTablePrivileges

SQLTablePrivileges returns a list of tables and the privileges associated with each table. The driver returns the information as a result set on the specified *hstmt*.

The following table describes the SQLSTATE and error values for **SQLTablePrivileges**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

SQLTables

SQLTables returns the list of table names that are stored in a specific data source. The driver returns this information as a result set.

The following table describes the SQLSTATE and error values for **SQLTables**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08S01	-11020	Communication-link failure
24000	-11031	Invalid cursor state
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1008	-11065	Operation canceled
S1010	-11067	Function-sequence error
S1090	-11071	Invalid string or buffer length
S1C00	-11092	Driver not capable
S1T00	-11094	Time-out expired
S1C00	-11300	SQL_DEFAULT_PARAM not supported
08S01	-11301	A protocol error has been detected. Current connection is closed.
S1000	-11310	Create and Drop must be executed within a ServerOnly Connection
S1000	-11320	Syntax Error
S1000	-11323	The statement contains an escape clause not supported by this database driver

SQLTransact

SQLTransact requests a commit or rollback operation for all active operations on all *hstmts* associated with a connection. **SQLTransact** can also request that a commit or rollback operation be performed for all connections associated with the *henv*.

The following table describes the SQLSTATE and error values for **SQLTransact**.

SQLSTATE	Error Value	Error Message
01000	-11001	General warning
08003	-11017	Connection not open
S1000	-11060	General error
S1001	-11061	Memory-allocation failure
S1010	-11067	Function-sequence error
S1012	-11069	Invalid transaction operation code
S1C00	-11092	Driver not capable
08S01	-11301	A protocol error has been detected. Current connection is closed.

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