SAS Publishing

SAS® ODBC Driver 9.1

User’s Guide and Programmer’s Reference

The Power to Know®

The correct bibliographic citation for this manual is as follows: SAS Institute Inc. 2004. *SAS® ODBC Driver 9.1: User's Guide and Programmer's Reference*. Cary, NC: SAS Institute Inc.

SAS® ODBC Driver 9.1: User's Guide and Programmer's Reference

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ISBN 1-59047-197-0

SAS Institute Inc., SAS Campus Drive, Cary, North Carolina 27513.

1st printing, January 2004

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CHAPTER
1

Introducing the SAS ODBC Driver

Overview: The SAS ODBC Driver

This book documents SAS 9.1 of the SAS ODBC driver. If you are using the Version 8 driver, you should see *SAS ODBC Driver User's Guide and Programmer's Reference, Version 8*.

This book is intended for three audiences:

- users who use the SAS ODBC driver to access data that is stored on their own computers*
- system administrators who use the SAS ODBC driver to enable multiple users to access shared data on a remote machine
- applications programmers and others who need detailed information about how the SAS ODBC driver is implemented.

This book assumes that you are familiar with the Microsoft Windows NT, Windows 2000, or Windows XP operating environments and that you know how to use a mouse and keyboard to perform common Windows tasks.

* See "Types of Data Accessed with the SAS ODBC Driver" on page 3 for information about what kinds of data you can access.

What Is ODBC?

ODBC stands for Open Database Connectivity. It is an interface standard that provides a common application programming interface (API) to access databases. Many software products that run in the Windows operating environment adhere to this standard so that you can access data that other software has created.

ODBC functionality is provided by three main components:

- □ the client application
- □ the ODBC driver manager
- □ the ODBC driver.

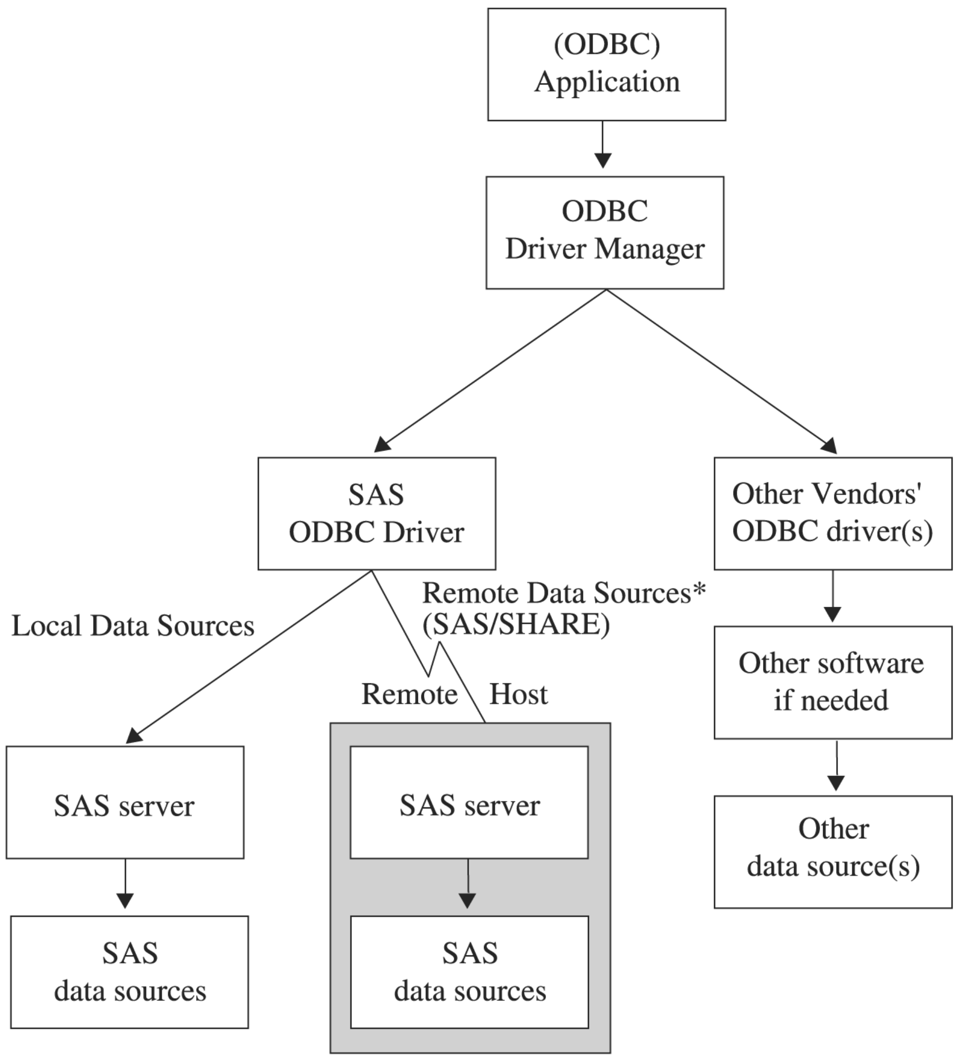
Figure 1.1 on page 3 displays components of ODBC functionality. The ODBC driver manager, which was developed by Microsoft, manages the interaction between a client application and one or more ODBC drivers.

What Is the SAS ODBC Driver?

The SAS ODBC driver is an implementation of the ODBC standard that enables you to access, manipulate, and update SAS data sources from applications that are ODBC compliant. As Figure 1.1 on page 3 shows, the SAS ODBC driver uses a SAS server to access data from your SAS data sources. The SAS server can be either a local, iconified SAS session or a remote SAS/SHARE server. (See "SAS Servers" on page 6 for more information.) If you use other ODBC drivers (such as those for ORACLE or SQL Server) to access other data sources, those drivers might require additional software components.

Note: To access ODBC data sources from within SAS (the opposite of what the SAS ODBC driver enables you to accomplish), you must license the SAS/ACCESS interface to ODBC. For additional information see *SAS/ACCESS for Relational Databases: Reference*. △

Figure 1.1 Components of ODBC Functionality



*To access remote data sources, the SAS ODBC driver requires TCP/IP communications software. You must also license SAS/SHARE and SAS/SHARE*NET on the remote host.

Types of Data Accessed with the SAS ODBC Driver

In Figure 1.1 on page 3 and elsewhere throughout this document, the term *SAS data sources* is used to describe data sources that you have defined in the SAS ODBC driver. These can include SAS data sets, flat files, and VSAM files, as well as data from many database management systems (DBMSs) through the use of SAS/ACCESS software. (See “SAS Data Sets” on page 5 for details.)

If your personal computer is connected to a TCP/IP network, you can access both local data sources and remote data sources. (See “What Software Do I Need?” on page 8 for information about software requirements.) *Local data* is data that you access through a SAS server on your local machine. The data can be stored either on your computer’s hard drive or on a network file system such as a Netware or Windows NT file server, that makes the physical location of the data transparent to applications. *Remote data* is data that you access through a SAS/SHARE server that runs on another (remote) machine.

The ability to use the SAS ODBC driver in conjunction with SAS/ACCESS software as a gateway to DBMS data is particularly useful under any of the following circumstances:

- □ There is no ODBC driver available for the DBMS. In this situation, you can use the SAS ODBC driver in conjunction with SAS/ACCESS on the SAS server to connect to the DBMS.
- □ You do not license the necessary software (either an ODBC driver for the DBMS or DBMS network access software) on your client machine.
- □ You want to join or merge DBMS data with other data.

Currently, SAS/ACCESS software is available for the following systems, including:

ADABAS

CA-Datacom/DB

CA-IDMS

CA-OpenIngres

DB2 under OS/390, UNIX, and Windows

IMS-DL/I

Informix

Microsoft SQL Server

ODBC

OLE DB Providers

ORACLE

Oracle Rdb

PC File Formats*

SYBASE

SYSTEM 2000 Data

Teradata

*This includes Lotus 1-2-3, Microsoft Excel (5, 7/95, 97, 2000, 2002), and Microsoft Access (97, 2000, 2002) file formats.

Note: You can use the SAS/ACCESS Interface to ODBC to access many sources that provide an ODBC driver, including AS/400, SQL Server, and Microsoft Access data. △

For information about the individual SAS/ACCESS interfaces, see "Recommended Reading" on page 49.

Understanding SAS

To use the SAS ODBC driver, you should understand three components of SAS:

- SAS data sets
- SAS data libraries
- SAS servers.

You should also understand how ODBC terminology corresponds to SAS terminology. See “SAS Terminology” on page 8 for more details.

SAS Data Sets

A SAS data set is a file structured in a format that SAS can access. The physical object contains

- data values that are stored in tabular form
- a descriptor portion that defines the types of data to SAS.

The physical locations of the data values and the descriptor are not necessarily contiguous.

SAS data sets have two forms: *data files* and *data views*. SAS data files are essentially relational tables with columns (or variables) and rows (or observations). The SAS data file structure can have many of the characteristics of a database management system, including indexing, compression, and password protection.

SAS data views are definitions or descriptions of data that resides elsewhere. They enable you to use SAS to access many different data sources, including flat files, VSAM files, and DBMS structures, as well as native SAS data files. A data view eliminates the need to know anything about the structure of the data or the software that created it. Data views take up very little storage because they contain no data. They also access the most current data from their defined sources because they collect the actual data values only when called.

You can use data views to define subsets of larger structures, or supersets of data that have been enhanced with calculated values. You can also create SAS data views that combine views of dissimilar data sources. For example, you can combine a view of a relational DB2 table with a view of a SAS data file, a view of hierarchical IMS-DL/I data, or even a view from a PC-based dBASE file.

You create SAS data views in three ways:

- with the DATA step (DATA step views)
- with the SQL procedure (PROC SQL views)
- with the ACCESS procedure (SAS/ACCESS views).

You can also use SAS/ACCESS software to work directly with DBMS tables such as DB2 and ORACLE, as if they were SAS data sets and views by using the SAS/ACCESS LIBNAME statement. See *SAS/ACCESS for Relational Databases: Reference* for more information.

Some variation occurs among these types of views:

DATA step views
: describe data from one or more sources, including flat files, VSAM files, and SAS data sets (either files or other views). You cannot use a DATA step view to update the view’s underlying data because DATA step views only *read* other files.

  For more information about how to create and use DATA step views, see the chapter “SAS Data Views” in *SAS Language Reference: Concepts*.

PROC SQL views

define either a subset or a superset of data from one or more SAS data sets. These data sets can be files or views, and can include data sets composed of DBMS data that are created with the SAS/ACCESS LIBNAME statement, and views that are created with the PROC SQL Pass-Through Facility to access DBMS data. You can also construct PROC SQL views of DBMS data by using an embedded LIBNAME statement.

For example, the SQL procedure can combine data from PROC SQL views, DATA step views, and SAS/ACCESS views with data in a SAS data file. You cannot use PROC SQL views to update the data in the view's underlying files or tables. However, with some restrictions, you can use the UPDATE, DELETE, and INSERT statements in the SQL procedure to update data that is described by SAS/ACCESS views.

For information about the PROC SQL Pass-Through Facility, see the chapter "The SQL Procedure" in *Base SAS Procedures Guide*, or *SAS/ACCESS for Relational Databases: Reference*.

SAS/ACCESS views

describe views that are created with the ACCESS procedure in SAS/ACCESS software. They are usually called *view descriptors* to distinguish them from PROC SQL or DATA step views. You can use them to describe data from any DBMS for which you license a SAS/ACCESS interface (see the list in "Types of Data Accessed with the SAS ODBC Driver" on page 3). Each view descriptor describes all or some of the data in one DBMS table or in one DBMS view. Some SAS/ACCESS interfaces do not permit you to use a view descriptor to update the underlying DBMS data.

For more information about view descriptors, see *SAS/ACCESS for Relational Databases: Reference*.

SAS Data Libraries

SAS data sets are contained in data libraries. Each SAS data library has two names: a physical name and a logical name (*libref*). The physical name of the library fully identifies the directory or operating system data structure that contains the data sets. Therefore, the physical name must conform to the rules for naming files within your operating system.

You use the libref to identify a group of data sets (files or views) within SAS. The libref is a temporary name that you associate with the physical name of the SAS data library during each SAS job or session. After the libref is assigned, you can read, create, or update files in the data library. A libref is valid only for the current SAS job or session and you can reference it repeatedly within that job or session.

You can also use SAS/ACCESS software to associate a SAS libref with a DBMS database, schema, server, or group of tables and views, such as a DB2 database or group of ORACLE tables and views. See *SAS/ACCESS for Relational Databases: Reference* for more information about using SAS/ACCESS software.

For more information about SAS data libraries, see the chapter "SAS Data Libraries" in *SAS Language Reference: Concepts*.

SAS Servers

To access your SAS data sources, the SAS ODBC driver uses a *SAS server*. A SAS server is a SAS procedure (either PROC SERVER or PROC ODBCSERV) that runs in its own SAS session. It accepts input and output requests from other SAS sessions and from the SAS ODBC driver on behalf of the applications that are ODBC compliant. While the server is running, the SAS session does not accept input from the keyboard.

Note: Beginning with Version 7 of SAS, the SAS ODBC driver uses the TCP/IP protocol to communicate with both local servers and remote SAS/SHARE servers. Support for the DDE protocol has been discontinued. Therefore, you should reconfigure your driver settings to change any DDE (local or network) servers to TCP/IP servers, as described in "Converting DDE Servers to TCP Servers" on page 7. △

The type of server that the driver uses depends on whether you are accessing local data or remote data:

local data
: The driver uses a SAS ODBC server to access your data. If you do not already have a SAS session running on your computer, the driver starts a SAS session and executes PROC ODBCSERV, thereby automatically starting the server when you connect to your local data source. See "Accessing Local SAS Data Sources" on page 26 for more information. If you have a SAS session (but not a SAS ODBC server) running on your computer, then you must either start the SAS ODBC server manually or end the SAS session before you connect to your SAS data sources (except under Windows NT, which supports multiple concurrent SAS sessions). See "Starting a SAS ODBC Server" on page 26 for details.

remote data
: The driver uses a SAS/SHARE server. This requires that you license the SAS/SHARE software on the remote host. The driver also requires TCP/IP software that is included with your operating environment to communicate with the server. Your server administrator uses PROC SERVER to start the server on your remote host. See "Accessing Remote (SAS/SHARE) Data Sources" on page 27 for more information.

The SAS ODBC driver can communicate with a SAS/SHARE server or a Scalable Performance Data (SPD) server. You can interchange SAS data and SPD server data by using the LIBNAME statement engine option in either SAS or SPD server.

Scalable Performance Data Server

The Scalable Performance Data (SPD) server utilizes the latest parallel processing methods and data server capabilities to efficiently access large volumes of data and serve large numbers of concurrent users. It provides efficient data access for hundreds of users across multiple processors.

The SPD server allows access to SAS data for intensive processing (queries and sorts) on the host server machine. It organizes and processes SAS data to take advantage of parallel processors on specific host servers.

The SPD SNET server handles communication between SAS clients and an SPD server. You must have the SPD server licensed on your client machine. Then you can interchange SAS data and SPD server data by using the LIBNAME statement engine option either in SAS or on the SPD server. For more information, see *Scalable Performance Data Server User's Guide*.

Converting DDE Servers to TCP Servers

If you still use SAS servers that are configured to use DDE, you must convert them to TCP servers to use them with this release of the SAS ODBC driver.

To convert a DDE (or Network DDE) server to a TCP server, perform these steps:

1 Install the new SAS ODBC driver.
2 Select the Servers tab from the SAS ODBC Driver Configuration dialog box.
3 Select the existing DDE server that you want to convert to TCP in the Servers list to the left of the Servers page.
4 Select $\boxed{\text{Configure}}$ to verify that the options are correct, and then select $\boxed{\text{OK}}$.

   Note: If you are converting from a local DDE server, you need to remove the **`-comamid dde`** option from the SAS Startup Parameters text box. △

5 Select $\boxed{\text{Update}}$ and then $\boxed{\text{OK}}$ to store your changes.

Note: For local TCP servers you will also have to verify that your TCP/IP Services file has an appropriate entry for the server that you are configuring. For more information, see "The TCP/IP Services File" on page 29. △

SAS Terminology

Software products often include similar components or constructs that are known by different names. For the ODBC standard and SAS, the following correspondences exist:

ODBC term	*SAS term*
owner	library name (libref)
table	data set
qualifier	not used

Therefore, if your application that is ODBC compliant asks you to specify the owner for a SAS data library, you should specify the libref. If the application asks for a table name, you should specify the name of the SAS data set. If a qualifier is requested, you can usually leave the field blank.

What Software Do I Need?

The SAS ODBC driver runs under 32-bit Windows (Windows NT, Windows XP, and Windows 2000). Other software requirements depend on your hardware configuration and on the data source(s) that you want to access, as shown in Table 1.1 on page 9.

Note: The 16-bit version (shipped with Releases 6.10, 6.11 and 6.12 of SAS) is downloadable from the SAS Web site and runs under Windows 3.1, 32s, and Windows for Workgroups. △

Table 1.1 Software Requirements

Data Source(s)	Configuration	Requirements
local SAS data only	Stand-alone PC	Base SAS*
local SAS data and local DBMS data	Stand-alone PC	Base SAS* SAS/ACCESS interface for each DBMS TCP/IP**
remote SAS data	PC on a network	*On PC:* SAS ODBC driver*** TCP/IP** *On remote host:* Base SAS SAS/SHARE TCP/IP**
remote SAS data and remote DBMS data	PC on a network	*On PC:* SAS ODBC driver*** TCP/IP** *On remote host:* Base SAS SAS/SHARE SAS/ACCESS interface for each DBMS TCP/IP**

* For local data access, base SAS software includes the SAS ODBC driver, but you install the driver separately.

** Requires a version of TCP/IP that supports the Microsoft Windows socket ("winsock") API.

***For remote data access, install the driver on your client PC. The SAS license for the remote host must include SAS/SHARE.

CHAPTER 2

Defining Your Data Sources

Introduction to Defining Data Sources

After you install the SAS ODBC driver,* you must provide information about the data source(s) that you want to access. This chapter explains how to use the SAS ODBC driver dialog boxes to provide the necessary information.

From the SAS ODBC dialog boxes, you can select **Help** at any time to obtain information about the active dialog box.

Accessing the SAS ODBC Driver Dialog Boxes

To access the SAS ODBC dialog boxes, complete these steps:

1 Access the Microsoft Windows Control Panel window by selecting

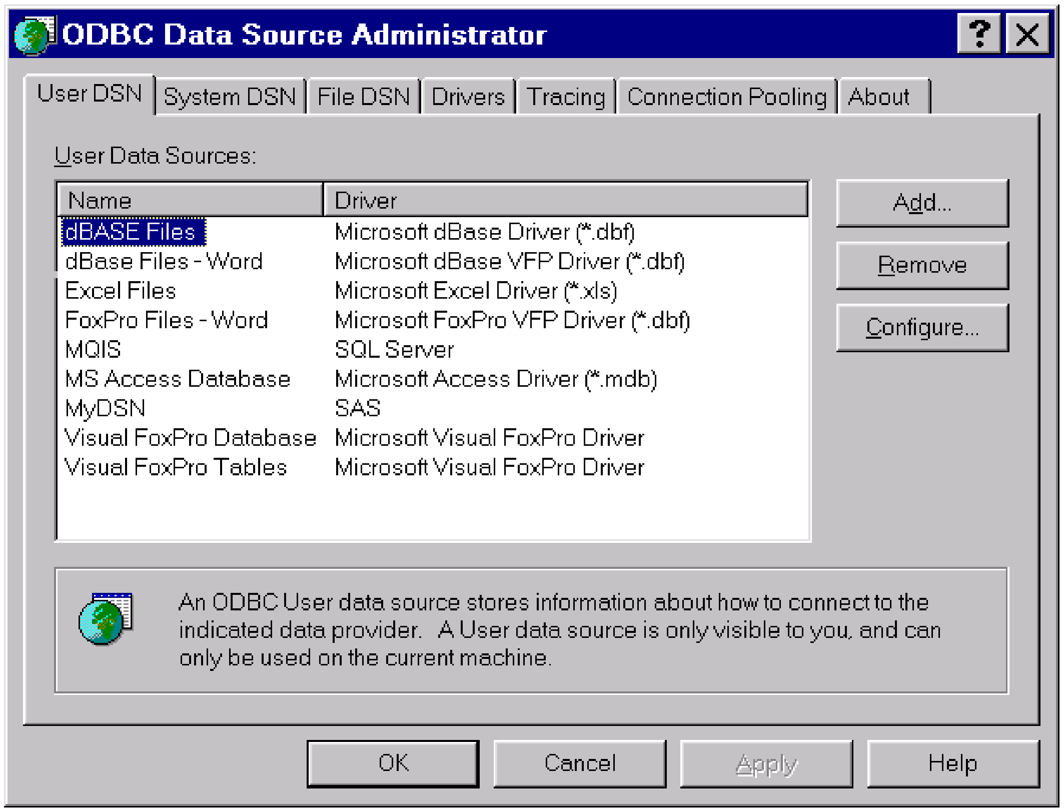
Start ▶ Settings ▶ Control Panel

Find the ODBC Data Sources or ODBC Administrator icon. This icon might be located in the Control Panel group, in an ODBC group, or, if you have installed a package of other ODBC drivers, it might be in a group that is associated with that package.

* See the installation instructions that are shipped with the driver diskette.

2 Double-click on the icon. Depending on the version of ODBC Administrator that you have installed (Windows NT 4.0 is shown below), you might see a slight variation in the following dialog box:

Display 2.1 ODBC Data Source Administrator

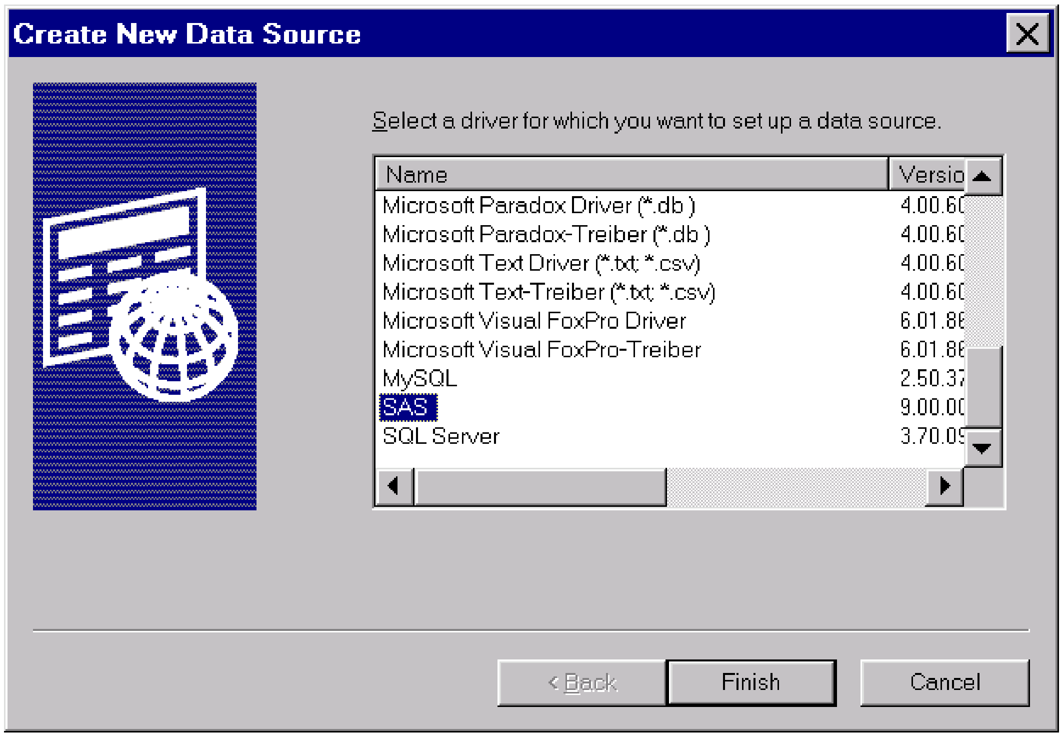


Name	Driver
dBASE Files	Microsoft dBase Driver (*.dbf)
dBase Files - Word	Microsoft dBase VFP Driver (*.dbf)
Excel Files	Microsoft Excel Driver (*.xls)
FoxPro Files - Word	Microsoft FoxPro VFP Driver (*.dbf)
MQIS	SQL Server
MS Access Database	Microsoft Access Driver (*.mdb)
MyDSN	SAS
Visual FoxPro Database	Microsoft Visual FoxPro Driver
Visual FoxPro Tables	Microsoft Visual FoxPro Driver

An ODBC User data source stores information about how to connect to the indicated data provider. A User data source is only visible to you, and can only be used on the current machine.

3 To add a new data source, select either the **`User DSN`** tab or the **`System DSN`** tab and select Add. The Create New Data Source dialog box appears.

Display 2.2 Create New Data Source Dialog Box



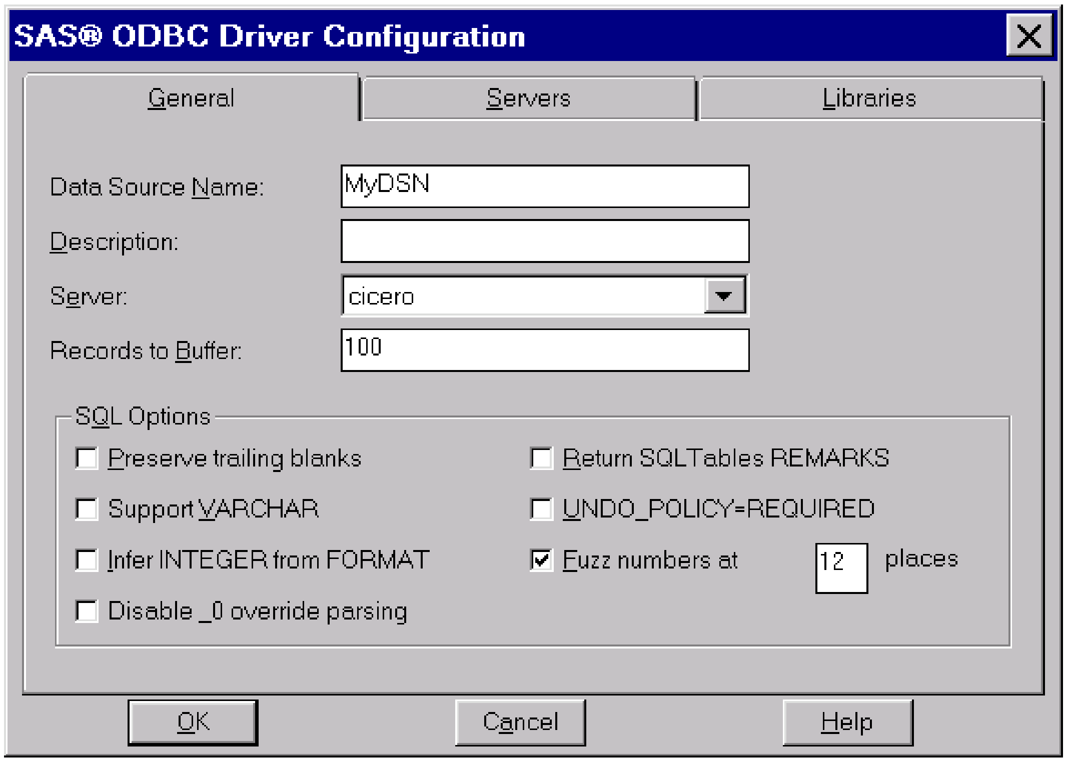
Name	Versio
Microsoft Paradox Driver (*.db)	4.00.60
Microsoft Paradox-Treiber (*.db)	4.00.60
Microsoft Text Driver (*.txt; *.csv)	4.00.60
Microsoft Text-Treiber (*.txt; *.csv)	4.00.60
Microsoft Visual FoxPro Driver	6.01.86
Microsoft Visual FoxPro-Treiber	6.01.86
MySQL	2.50.37
SAS	9.00.00
SQL Server	3.70.09

4 To select the SAS ODBC driver, scroll down the list of Installed ODBC drivers (if necessary) and select **SAS**. Click Finish .

Note: Select **SAS** even if you are going to use a SAS data view to access data that is not SAS. See "SAS Data Sets" on page 5 for information about SAS data views. △

The SAS ODBC Driver Configuration dialog box appears.

Display 2.3 SAS ODBC Driver Configuration Dialog Box


SAS® ODBC Driver Configuration

General | Servers | Libraries

Data Source Name: MyDSN

Description:

Server: cicero

Records to Buffer: 100

SQL Options

- [ ] Preserve trailing blanks
- [ ] Support VARCHAR
- [ ] Infer INTEGER from FORMAT
- [ ] Disable _0 override parsing
- [ ] Return SQLTables REMARKS
- [ ] UNDO_POLICY=REQUIRED
- [✓] Fuzz numbers at 12 places

At the top of this dialog box are three tabs: **General**, **Servers**, and **Libraries**. Select these tabs to move from one page to the next. On each page, supply information about the data source that you want to be able to access.

After you have supplied all the necessary information, select OK from any page to save your data source definition. Selecting Cancel discards any new or changed information that you have supplied and returns you to the ODBC Data Source Administrator dialog box (Display 2.1 on page 12).

Setting Up Your Data Source

When you first access the SAS ODBC Driver Configuration dialog box, the **General** page is in the foreground, as shown in Display 2.3 on page 14. Follow these steps:

1 In the **Data Source Name** field, enter a name for the data source that you want to access. The name must begin with a letter, and it cannot contain commas, semicolons, or any of the following special characters: **[ ] { } ( ) ? * = ! @.** For example, if you are defining SAS data that is stored on a machine named **CICERO**, you might call your data source **SAS_CICERO**. If you or other users are concerned only with the type of data (or with the type of application that uses that data), and not with where the data is stored, then you might have data sources with names like **Finance** or **Payroll**.

2 (Optional) In the **Description** field, supply a description of the data source.

3 The **Server** field includes a drop-down list that you select in order to expand the list of defined servers. The first time you define a data source, the list is empty.

Define one or more servers (as described in the next section), and then come back to the **`General`** page to make a selection from the Server list. You must specify a server for every data source.

4 In the **`Records to Buffer`** field specify the number of rows to request from the SAS/SHARE server in a single transmission. The default value is 100 and the maximum value is 32,000.

The size of the server's transmission buffers limits the actual number of rows returned. Usually you will not change the default value. However, specifying a larger value might improve performance when you retrieve a very large result set.

Specifying SQL Options

SQL options affect the interaction between the SAS ODBC driver, SAS, and applications that are ODBC compliant. The default settings for the options are those that most applications that are ODBC compliant will expect and will work best with. However, you can override the defaults by selecting any of the SQL Options listed. Select the box next to the desired option.

`Preserve trailing blanks`
preserves trailing blanks at the end of character fields. The default action is that trailing blanks are removed, so that each field ends in a null value.

`Support VARCHAR`
causes character fields that are longer than 80 characters to be reported as variable-length fields, and causes the trailing blanks to be removed. See "Support VARCHAR Option" on page 41 for more information.

`Infer INTEGER from FORMAT`
causes SAS numeric data types (typically reported as SQL_DOUBLE) to be reported as SQL_INTEGER. See "Infer INTEGER from FORMAT Option" on page 41 for more information.

`Disable _0 override parsing`
prevents the SAS ODBC driver from removing the _0 string from SQL queries. See "Disable _0 override parsing Option" on page 41 for more information.

`Return SQLTables REMARKS`
causes the SAS ODBC driver to read and return the SAS data set label for each data set in the library you are accessing. (SQLTables is the name of an ODBC function that can be used for this purpose.) For SAS data sets, this can have a negative impact on performance, because each data set must be opened in order to read the label. Therefore, you should not select this option unless there is information in the label that you really need to see.

`UNDO_POLICY=REQUIRED`
implements the UNDO_POLICY option of SAS' SQL procedure with a setting of REQUIRED. With this setting, INSERT or UPDATE operations that fail are undone. However, this action is performed only for operations that affect multiple records; a statement that affects a single record behaves the same regardless of the UNDO_POLICY setting. When UNDO_POLICY=REQUIRED, the associated statement handle (**`hstmt`**) of an UPDATE or INSERT statement must be the only active **`hstmt`** against the table. If another user, or an **`hstmt`** within the same user's application, has an active SELECT statement, then the UPDATE or INSERT statement fails.

Fuzz Numbers at N Places
specifies the degree of precision to use when comparing numbers. See "Fuzz Numbers at N Places Option" on page 41 for more information. By default, this option is selected. You can change the default value, 12, by typing over it.

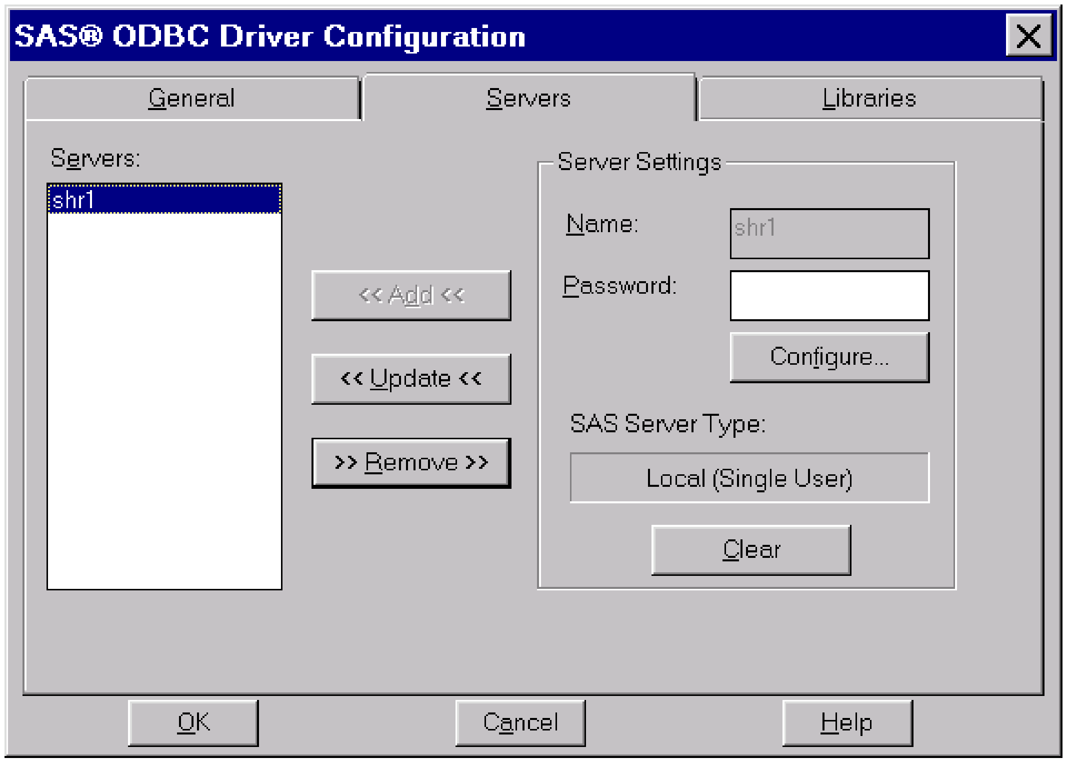
Defining Servers

The SAS ODBC driver uses a SAS server to access your data sources. To access local data, the driver uses a SAS ODBC server. To access remote data, it uses a SAS/SHARE server. (See "SAS Servers" on page 6 for more information.)

This section explains how to provide the SAS ODBC driver with necessary information about the server(s) you will be using.

1 Select the **Servers** tab in the SAS ODBC Driver Configuration dialog box to go to the **Servers** page. Supply the information described in the following steps. If at any time you want to clear all of the fields on the right side of the dialog box and start again, select Clear .

Display 2.4 Servers Page



2 In the **Name** field, enter a name for the SAS server that you are defining. If you supply a one-part name such as **shr1**, the SAS ODBC driver infers that the server is a local SAS ODBC server. **Local (Single User)** appears in the SAS Server Type field.

If you supply a two-part name such as **`machine.shr2`**, the driver infers that the server is remote. **`SAS/SHARE (Multi-User)`** appears in the SAS Server Type field.*

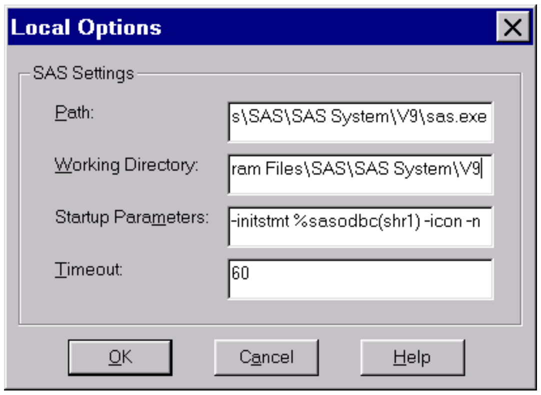
The difference between local and remote servers is important and can cause errors if your configuration specifies the wrong type of server. See "SAS Servers" on page 6 for more information.

3 If user access to the server is password protected, then enter the password in the **`Password`** field. This should be the same password that was specified for the **`UAPW=`** option in PROC SERVER (for a SAS/SHARE server), or in PROC ODBCSERV (for a local access server).

4 Select Configure. A configuration dialog box appears.

If you specified a one-part server name in the **`Name`** field of the **`Servers`** page (Display 2.4 on page 16), then the SAS ODBC driver infers that you are using a local SAS server. The Local Options dialog box appears.

Display 2.5 Local Options Dialog Box


Local Options
SAS Settings
Path: s\SAS\SAS System\V9\sas.exe
Working Directory: ram Files\SAS\SAS System\V9
Startup Parameters: -initstmt %sasodbc(shr1) -icon -n
Timeout: 60

When you access a local SAS data source from an application that is ODBC compliant, the SAS ODBC driver uses the information in this dialog box to invoke a SAS ODBC server, provided there isn't one already running. (If a SAS ODBC server is already running, the driver finds it and connects to it.) Each field contains default values that you can change by typing over them.

`Path:`
This field specifies the fully qualified path name for the SAS executable file (SAS.EXE) that you use to start a SAS session. The default path is **`C:\Program Files\SAS\SAS System\9.1\sas.exe`****. If this field is empty, then no attempt is made to start a SAS ODBC server when you connect to your data source.

* The SAS ODBC driver communicates with either a SAS/SHARE server or an SPD server. If you add a server that uses the SPD SNET server, **`SAS Server Type`** appears as **`SAS/SHARE (Multi-User)`**. This will not cause a problem using the SPD server.
The driver interprets the first part of the name as an alias for the TCP/IP network machine name and the second part as the server name. The server name must match both the **`ID=`** field in PROC SERVER (the SAS/SHARE server that is running on the remote host), and the *server-name* that you (or your server administrator) specified when you defined the server as a service in the TCP/IP Services file. See "The TCP/IP Services File" on page 29 for more information.

** The SAS ODBC driver queries the registry for the current version of SAS and the value of **`DefaultRoot`**. This value is concatenated with **`\sas.exe`** to create the default path. The default working directory is the value of DefaultRoot.

Working Directory:
This field specifies the fully qualified path name for the directory that you want to use as the SAS working directory. This directory is usually where your SAS program files and documents are located. The default is **C:\Program Files\SAS\SAS System\9.1**.

Startup Parameters:
This field specifies the parameters that are used to invoke SAS. The default values are: The initialization statement (**-initstmt**) executes a SAS macro (**%sasodbc**), which in turn invokes the ODBC server. The **shr1** value is only an example. It is a SAS macro parameter whose value is taken from the name that you specified in the **Name** field of the **Servers** page (Display 2.4 on page 16). The **-icon** option specifies that the server session should be invoked in iconified mode, because no interaction with the server is required. The **-nologo** option (not shown) specifies that the SAS session will be invoked without displaying the SAS logo and copyright information.

The **%sasodbc** macro is shipped with SAS and is found in !SASROOT\CORE\SASMACRO\SASODBC.SAS.* The SASODBC.SAS file executes the SAS procedure PROC ODBCSERV.

The SASODBC.SAS file can be modified to add additional SAS options or SAS statements such as the LIBNAME statements mentioned in "Defining Libraries at Server Startup Time" on page 22. You can also specify options for PROC ODBCSERV. The available options are the same as those for PROC SERVER. See *SAS/SHARE User's Guide* for details.

An additional option, LOG=QUERY, is particularly relevant for servers that are used by the SAS ODBC driver. This option causes the server to log SQL queries. (By default, the server logs update and output operations, but not queries.) Hence, this option is useful when you need to see the queries that the server receives from an ODBC client application.

If your SAS session is installed on a network drive and is shared by multiple users, then you probably don't want individual users to modify the SASODBC.SAS file. Instead, users can make their own copies of the file and can store them in their personal libraries. In this case, they must also add the **-sasautos** option either to the **Startup Parameters** field or to their local CONFIG.SAS file to indicate the pathname for the library, as in the following example:

```
-sasautos c:\programs\sas
```

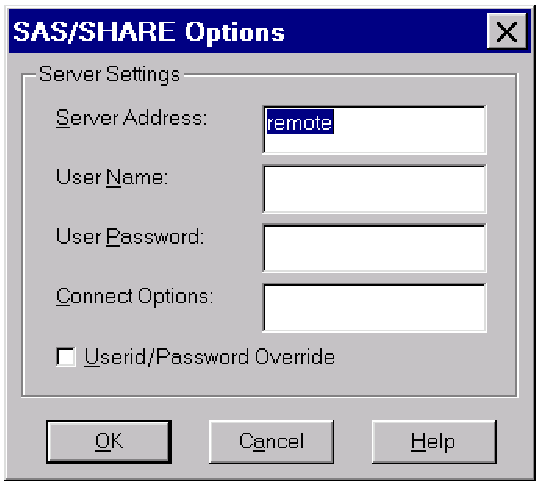
For more information about SAS system options and SAS statements, see *SAS Companion for Windows*.

Timeout:
This field specifies in seconds how long to wait for the local SAS ODBC server to start and to register itself. The default is 60 seconds.

If you specified a two-part server name before selecting Configure, the SAS/SHARE Options dialog box appears.

* !SASROOT is a logical name for the directory in which you install SAS. For more information, see *SAS Companion for Windows*.

Display 2.6 SAS/SHARE Options Dialog Box


SAS/SHARE Options

Server Settings

Server Address: remote

User Name:

User Password:

Connect Options:

☐ Userid/Password Override

Supply the requested information in these fields:

`Server Address:`

This field is automatically filled with the alias for the TCP/IP network machine name that you specified in the **`Name`** field of the **`Servers`** page (Display 2.4 on page 16). In a complex networking environment, you might need to supply a fully qualified domain address for the server (for example, **`machine.sas.com`**).

`User Name:`

This field is for your user ID on the system where the server is running. It is required if the server is running in secured mode; otherwise, it is ignored.

`User Password:`

This field is for your password on the system where the server is running. If you supply a **`User Name`** without a **`User Password`**, then you will be prompted for a password at connection time. The SAS ODBC driver automatically encrypts the password. For more information about password encryption, see "Encrypting Passwords" on page 31.

`Connect Options:`

This field provides additional connection options to use when you define a connection that will point to an SPD SNET server. You must leave **`Connect Options`** blank for a connection to a SAS/SHARE server to work properly.

An SPD SNET server is an intermediate component between the ODBC driver and an actual SPD server.

Specify the connection options as name value pairs delimited by white space. Each of the values must be in single quotation marks. For example,

```
DBQ='tmp' HOST='bigone.unx.sas.com' SERV='5129'
```

where:

DBQ is the SPD server libname domain.

HOST is the location of the host computer on your network where the SPD name server is running.

SERV is the port number of the SPD name server running on the HOST.

See the documentation shipped with the SPD server for more details.

`Userid/Password Override`
This field requests that the UID keyword and PWD keyword be used in the ODBC client application. The ODBC driver will pass the value of the PWD keyword as the user login password, and the value of the UID keyword as the user ID. Otherwise, the driver will use the value of the PWD keyword from the server definition as the authentication password. For more information about using this option, see “Userid/Password Override” on page 28.

5. When you have finished making any necessary changes to the Local Options or SAS/SHARE Options dialog box, select OK to return to the **`Servers`** page (Display 2.4 on page 16).
6. *Important!* Select <<Add<< to save your server definition. The server name now appears in the list of defined servers at the left.
7. To define another server, select Clear and then repeat steps 2-7.

Deleting a Server Definition

To delete a previously defined server, complete these steps:

1. Select the server name from the **`Servers`** list at the left of the **`Servers`** page.
2. Select >>Remove>>.

CAUTION:
If you delete a server, then any data sources that use that server will no longer be accessible until you redefine that server. △

Modifying a Server Definition

To change the information for a previously defined server, complete these steps:

1. Select the server name from the **`Servers`** list at the left of the **`Servers`** page.
2. To make the desired changes, select Configure to make changes in the Local Options or SAS/SHARE Options dialog box (Display 2.5 on page 17 and Display 2.6 on page 19).

   The **`Name`** field is dimmed to indicate that you cannot change the name of the server. The reason for this is that you may have already defined data sources that use that server—if you changed the server name, then you would no longer be able to access those data sources.
3. Select <<Update<< to save your changes.

For instructions on how to specify a different server for a data source that you have already defined, see “Specifying a Different Server for a Defined Data Source” on page 23.

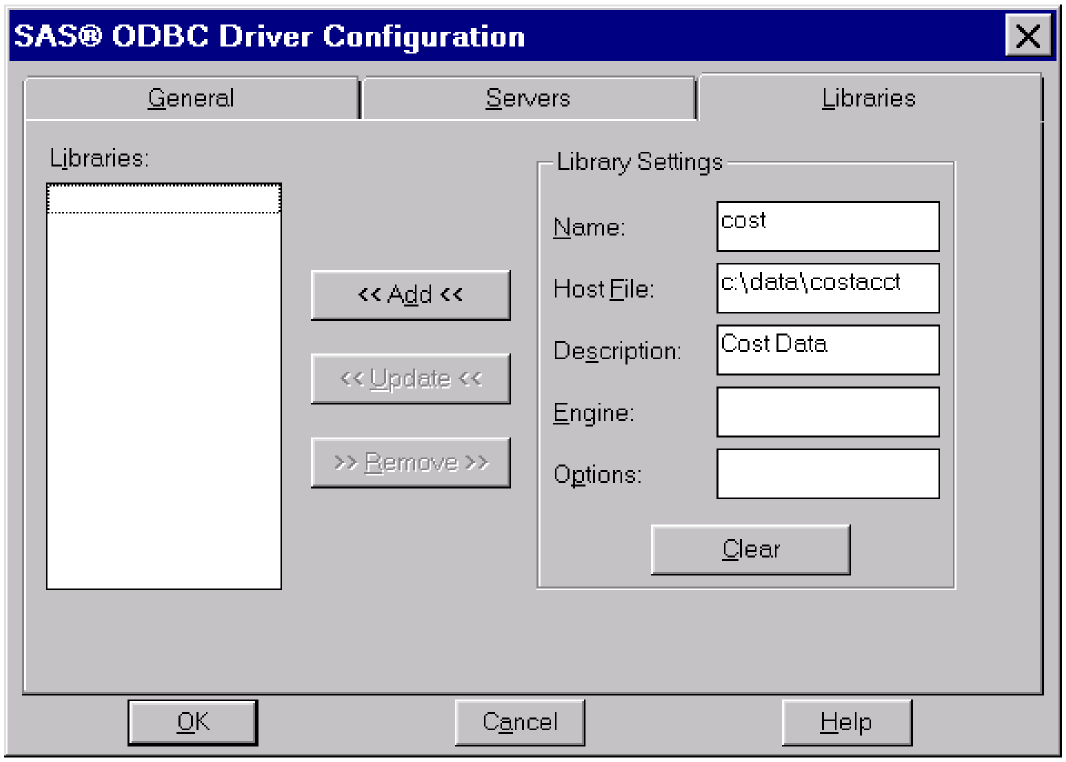
Defining Data Libraries

Each data source can include multiple data libraries. (See “SAS Data Libraries” on page 6 for information.) Therefore, you provide information about each library that you want to access.

This section describes how to use the **`Libraries`** page to define your data libraries. See “Defining Libraries at Server Startup Time” on page 22 for information about an alternate way of defining data libraries.

1 Select the **`Libraries`** tab in the SAS ODBC Driver Configuration dialog box to go to the **`Libraries`** page (Display 2.7 on page 21). Supply the information described in the following steps. If at any point you want to clear all of the fields on the right side of the dialog box and start again, select Clear.

Display 2.7 Libraries Page



Name: cost
Host File: c:\data\costacct
Description: Cost Data
Engine:
Options:

2 In the **`Name`** field, enter a name for an existing physical SAS data library that you want to access. (For those who are familiar with SAS, this field corresponds to the *libref* in the SAS LIBNAME statement.) The name can be up to eight characters long. The first character must be a letter or an underscore. Subsequent characters can be letters, numeric digits, or underscores. Blanks and special characters are not allowed. For example, you might use the name **`cost`** to designate a library of cost-accounting data.

The SAS data library can include SAS data files, SAS data views, or both. See "SAS Data Sets" on page 5 for more information.

Note: If you use an ODBC application that exports databases using one-level names, you will need to define a library called **`user`**. △

3 In the **`Host File`** field, enter the physical name of the library. This must be a valid pathname for the operating system that your data library is stored in. For example, for a library that is stored on a PC in the Windows environment, **`c:\data\costacct`** would be a valid pathname.

4 (Optional) In the **`Description`** field, supply a description of the library, to remind yourself or other users of what the library contains.

5 (Optional) In the **`Engine`** field, enter the name of the SAS engine that is required for writing to and reading from this library. This is necessary only if you do not want the SAS server to use the default engine for the version and release number of SAS that you are running. (For SAS 9.1, the default engine would be **`V9`**.) For information about other engines that might be available, see the description of the LIBNAME statement in the SAS Companion for the operating system under which your data library is stored.

6 (Optional) In the **Options** field, you can enter the following option for the library that you are defining:

ACCESS=READONLY
: This option limits users to "read-only" access to the SAS data sets in the library.

7 Select $\boxed{\text{<<Add<<}}$ to save your library information. The library name is added to the Libraries list at the left.

8 To include another data library with your data source, repeat steps 2-7.

Defining Libraries at Server Startup Time

Server administrators might prefer to define SAS data libraries at server startup time rather than defining them through the SAS ODBC driver dialog boxes. Defining libraries at server startup time can make opening the data source faster. It also enables you to avoid hardcoding the physical names of your libraries in your SAS ODBC data-source definitions.

As explained in "SAS Servers" on page 6, the SAS ODBC driver uses a SAS/SHARE server (invoked by PROC SERVER) to access remote data sources. It uses a SAS ODBC server (invoked by PROC ODBCSERV) to access local data sources. To define a data library at server startup time, you precede the PROC SERVER or PROC ODBCSERV statement with a SAS LIBNAME statement. For example, you could define a library of cost-accounting data to a SAS/SHARE server as follows:

```
libname cost 'e:\fin\acct';
proc server id=acctserv authenticate=optional;
run;
```

Note: Depending on whether the server is running in secured mode or not, the **authenticate=optional** option might not be needed. △

To define this library to a SAS ODBC server, you would add only the above LIBNAME statement to the !SASROOT\CORE\SASMACRO\SASODBC.SAS file. See Startup Parameters on page 18 for more information.

When a user requests access to the particular SAS ODBC data source from an ODBC client application, the server would automatically make this library available, along with any libraries that were defined via the SAS ODBC Libraries page.

For more information about the SAS LIBNAME statement, see the SAS Companion for the operating system under which your data library is stored.

Deleting a Data Library Definition

To delete a previously defined data library, complete these steps:

1 Select the library name from the **Libraries** list at the left of the **Libraries** page (Display 2.7 on page 21).

2 Select $\boxed{\text{>>Remove>>}}$.

Modifying a Data Library Definition

To change the information for a previously defined library, complete these steps:

1 Select the library name from the **`Libraries`** list on the **`Libraries`** page.

2 Make the desired changes to the **`Host File`**, **`Description`**, **`Engine`**, and **`Options`** fields.

3 Select $\boxed{\text{<<Update<<}}$ to save your changes.

Saving a Data Source Definition

When you have finished defining your data source, select $\boxed{\text{OK}}$ to save your data source definition and return to the ODBC Data Source Administrator dialog box (Display 2.1 on page 12). Your newly defined data source now appears in the list of Data Sources on the left.

You can either add additional data sources, or select $\boxed{\text{OK}}$ to return to the Microsoft Windows Control Panel (or to the location from which you entered the ODBC Data Source Administrator dialog box).

Modifying a Data Source Definition

To modify a previously defined data source, complete these steps:

1 Select the name of the data source from the ODBC Data Source Administrator dialog box (Display 2.1 on page 12).

2 Select $\boxed{\text{Configure}}$. The SAS ODBC Driver Configuration dialog box (Display 2.3 on page 14) appears.

3 Use the tabs in this dialog box to access other SAS ODBC pages. Use the other pages as described in previous sections to modify server definitions, library definitions, or SQL options.

4 When you are finished, select $\boxed{\text{OK}}$ to save your changes.

Specifying a Different Server for a Defined Data Source

Suppose a data source named **`Payroll`** has been moved from a server named **`CICERO`** to one named **`DAVINCI`**. In this case, you need to change the server that you specified for the **`Payroll`** data source by completing these steps:

1 Select the **`Payroll`** data source from the ODBC Data Source Administrator dialog box (Display 2.1 on page 12).

2 Select $\boxed{\text{Configure}}$. The SAS ODBC Driver Configuration dialog box (Display 2.3 on page 14) appears, with **`CICERO`** listed in the **`Servers`** field.

3 Use the **`Servers`** page to define the **`DAVINCI`** server, if it is not already defined.

4 From the **`General`** page, if **`DAVINCI`** is not already visible in the **`Servers`** field, select the drop-down list icon next to that field, and then select **`DAVINCI`** from the list.

5 Select $\boxed{\text{OK}}$ to save your changes.

Note: The server name specified must be defined in the TCP/IP Services file. For more information, see “The TCP/IP Services File” on page 29. △

Deleting a Data Source Definition

To delete a previously defined data source, complete these steps:

1. Select the name of the data source from the ODBC Data Source Administrator dialog box (Display 2.1 on page 12).
2. Select $\boxed{\text{Remove}}$.

CHAPTER 3

Using the SAS ODBC Driver

Introduction to Using the SAS ODBC Driver

This chapter provides an overview of how to use the SAS ODBC driver to access your SAS data sources. It also provides information about the SAS servers and the communications software that are used by the driver and about SQL syntax and return codes that are supported by the driver.

Accessing Your Data Sources

The details of how you access your SAS data sources depend on which ODBC-compliant application you are using (for example, Microsoft Access or Excel), and on whether you are accessing local or remote data. However, here are the steps that you follow:

1 Install the SAS ODBC driver. (Refer to the installation instructions that are shipped with the driver.) The installation program provides the SAS driver for the ODBC Data Source Administrator to use.
2 Double-click on the Data Sources (ODBC) icon in the Control Panel window to access the ODBC and SAS ODBC Data Source Definition dialog boxes.

3 Use these dialog boxes to provide the SAS ODBC driver with the necessary information about your SAS data source(s). (See Chapter 2, “Defining Your Data Sources,” on page 11 for instructions.) In addition to SAS data files, SAS data sources can include DATA step views, PROC SQL views, or SAS/ACCESS views, all of which contain definitions of data that is stored elsewhere rather than the physical data itself. (See “Types of Data Accessed with the SAS ODBC Driver” on page 3 and “SAS Data Sets” on page 5.)

4 The next step depends on whether you want to access local data or remote data:

Note: TCP/IP (Winsock) is required for accessing local data sources, remote data sources, or both. △

- □ To access local data see “Accessing Local SAS Data Sources” on page 26.
- □ To access remote data sources, see “Accessing Remote (SAS/SHARE) Data Sources” on page 27.

5 Consult the documentation for your Windows application for instructions on how to access or import data from other sources. From the list of available data sources, select or specify the name that you assigned to your SAS data source.

6 Select or enter the name of the desired SAS data library (if required by your application).

7 Select or enter the name of the desired SAS data file or view.

For information about configuring file DSNs for applications that are ODBC compliant that only support the use of file DSNs (such as Microsoft Excel 97), see the online Help that is available when you configure data sources in the ODBC Data Source Administrator and press Help.

Prerequisites for Communications

The SAS ODBC driver interacts with other software to provide you with access to your data sources. Certain prerequisites apply, depending on whether you want to access local data or remote data. These prerequisites are described in the following sections.

Accessing Local SAS Data Sources

To access local SAS data sources, the SAS ODBC driver uses a SAS ODBC server in conjunction with TCP/IP. You must edit your TCP/IP Services file to define your servers before starting the SAS ODBC server. It is not necessary for the server to be running when you *define* your data sources. However, the server must be running on your PC in order for you to *access* your SAS data sources. For information about editing the TCP/IP Services file, see “The TCP/IP Services File” on page 29. For more information about SAS servers, see “SAS Servers” on page 6.

Starting a SAS ODBC Server

If there isn’t already a SAS ODBC server running on your PC, the SAS ODBC driver uses the information that you supplied in the Local Options dialog box (described in Display 2.5 on page 17) to automatically start one for you. That is, you do not need to take any action to start the server.

If you already have a SAS session running on your PC, then you can start the SAS ODBC server in that session by submitting the following statements:

```
options comamid=tcp;
proc odbcserv id=server-name authenticate=optional;
run;
```

The *server-name* must be the same as the name you specified on the Servers page when you defined your local data source, as explained in "Defining Servers" on page 16.

Alternatively, you can terminate your SAS session so that the SAS ODBC driver can start a SAS ODBC server for you in a new SAS session.*

Note: When the server is running in a SAS session, the SAS session does not accept user input from the keyboard. △

If the SAS session cannot be started before the **SAS Timeout** value that you specified in the Local Options dialog box is reached, a time-out error is returned to your ODBC client application. An error message is also returned to the client if the SAS session was started but PROC ODBCSERV could not execute.

Terminating the SAS ODBC Server

When you are finished using your ODBC client application to access your local SAS data sources, the SAS ODBC server continues to execute in case you want to access additional SAS data sources. To terminate the server, do either of the following tasks:

- Open the Windows Task List window and press the Ctrl, Alt and Delete keys simultaneously and select **Task Manager** from the Windows NT Security dialog box. You can also use the Ctrl, Shift, and Escape keys to immediately invoke the Task Manager. Under the **Applications** tab, select **SAS** from the list of tasks, and then select **End Task**. Alternatively, under the **Processes** tab, select **SAS.EXE** in the Image Name column and select **End Process**.
- Bring the SAS session into focus (make it the active window), and then press the Ctrl and Break keys simultaneously. The Task Manager appears. Select **ODBCSERV** from the list of tasks and click OK. Click OK again to halt the procedure.

Accessing Remote (SAS/SHARE) Data Sources

To access remote data sources, the SAS ODBC driver uses a SAS/SHARE server. (See "Accessing Remote (SAS/SHARE) Data Sources" on page 27 for more information. See *SAS/SHARE User's Guide* for complete information about SAS/SHARE .) It is not necessary for the server to be running when you *define* your data sources. However, the server must be running on your remote host in order for you to *access* your data sources.

Because a SAS/SHARE server is used by multiple users, it is usually invoked on the remote host at system startup time. Therefore, users usually do not need to take any local action to invoke the server.

Whoever is responsible for starting the SAS/SHARE server (you or your server administrator) must complete these steps:

1. Define the server(s) in the TCP/IP Services file for the *client* machine(s) that are running the server(s).* (For more information, see "The TCP/IP Services File" on page 29.)
2. Create a SAS program that contains the following SAS statements:

* Under Windows NT, it is not necessary to terminate the SAS session because you can run multiple SAS sessions in that environment.

* Refer to the documentation for your TCP/IP software to find the path name for the Services file.

```
options comamid=tcp;
proc server id=server-name authenticate=optional;
run;
```

Invoke this program to run in the background using proper host-specific command syntax. See *Communications Access Methods for SAS/CONNECT and SAS/SHARE* for additional information.

Userid/Password Override

The Userid/Password Override option is in the SAS/SHARE Options dialog box of the Servers page. This option enables you to use the UID keyword and PWD keyword in the ODBC client application so that the driver passes the value of the PWD keyword as the user login password and the value of the UID keyword as the user ID. Otherwise, the driver will use the value of the PWD keyword from the server definition as the authentication password.

By default, the SAS ODBC driver uses the value of the ODBC PWD keyword to mean the SAS/SHARE server authentication password (UAPW= option on PROC SERVER). However, most ODBC users intuitively associate the PWD keyword with a user login password such as a Windows NT or UNIX user login password. This can pose a problem if you connect to a remote secure server and you want to specify a different user ID and password at runtime.

The following example starts a SAS/SHARE server and uses the PWD option as the server authentication password:

```
/* SAS/SHARE User Access password is set      */
/* System username and password not required  */
proc server id=shr1 UAPW=sapw authenticate= opt;
run;
```

If an ODBC DSN named is created with the server authentication password field in the server definition set to **pwsa**, then the connections that use SampleDSN will fail. This is because the password field does not match the PROC SERVER value. ODBC client applications can override keyword defaults at connect time by specifying a PWD= option in the program.

The following SAS code uses SAS/ACCESS for ODBC to connect successfully to the DSN SampleDSN by overriding the PWD keyword:

```
/* The PWD= option value matches the UAPW= option for   */
/* remote PROC SERVER, so the connection should succeed.*/
proc sql;
   connect to odbc (dsn=SampleDSN pwd=sapw);
   select * from connection to odbc
   (select * from dictionary.columns);
quit;
```

Instead of using just the PWD value as the SAS/SHARE server access password, you can use the Userid/Password Override option to force the ODBC driver to use the UID and PWD values for authentication at the system level. The following example demonstrates this option when you start a SAS/SHARE server and configure the TCP/IP communications access method to require authentication for all connecting clients:

```
/* Start a remote secured SAS/SHARE server that requires  */
/* requires system username and password from the client. */
/* the SAS/SHARE user access password is not required     */
%let tcpsec=_secure_;
proc server id=shr1 authenticate=req;
```

```
run;
```

If the ODBC DSN is named SampleDSN and the user login ID of **`iamuser`** and user login password of **`iampw`** are stored in the server definition, then you can use the following SAS program to connect to the DSN SampleDSN:

```
proc sql;
   connect to odbc (dsn=SampleDSN);
   select * from connection to odbc
  (select * from dictionary.columns);
quit;
```

Perhaps your system administrator requests not to store user names and passwords in DSNs, or your password on the remote system changed from **`iampw`** to **`iarepw`**. The ODBC specification allows ODBC client applications to override the user ID and password with the UID option and the PWD option in the source code. Now you can use the following SAS program to connect to the DSN SampleDSN:

```
proc sql;
   connect to odbc (dsn=SampleDSN uid=iamuser pwd=iarepw);
   select * from connection to odbc
  (select * from dictionary.columns);
quit;
```

If you enable the Userid/Password Override option in the SAS/SHARE Options dialog box for SampleDSN, then the driver will recognize UID and associate PWD with the user login password. The above connection will succeed because the server does not use the server authentication password. However, by default, this program fails because the SAS ODBC driver does not recognize the UID keyword. Instead, the driver associates PWD with the SAS/SHARE server authentication password.

The TCP/IP Services File

The TCP/IP Services file contains information about the names of the available services on the machine, along with the port number, protocol name, and any aliases corresponding to each service. For the purposes of the SAS ODBC driver, each entry in this file associates a SAS server (service name) with the port number and protocol used by that service. The location of the Services file varies on different platforms. To configure the SAS ODBC driver correctly, you must locate the Services file for your platform. Common locations for the Services file are

Windows	C:\WINNT\SYSTEM32\DRIVERS\ETC\SERVICES
UNIX	/etc/services

Entries in the services file take the following general form:

```
<official service name> <port number/protocol name> <aliases> #
<comments>
```

Note: You must update the services file on both the server and ODBC client machines when you access remote SAS data sources. △

Editing the TCP/IP Services File

To configure your Services file for use with the SAS ODBC driver, you must add an entry to the services file for each SAS server (either local or remote) that you have configured using the ODBC Administrator.

The port number that you use should be an unused port number in this file (for larger networks, contact your network administrator to obtain an available port number). The port number must be greater than 1024, as any port number equal to or less than 1024 is reserved. The protocol must always be **`tcp`**. The server name must be from one to eight characters long. The first character must be a letter or an underscore; the remaining seven characters can include letters, digits, underscores, the dollar ($) sign, or the at (@) sign. You specify the same server name on the Servers page when you define your data source as explained in "Defining Servers" on page 16.

For example, if, in the ODBC Administrator, you have configured a local ODBC server named **`shr1`** and a remote SAS/SHARE server named **`machine.shr2`** you would add entries to the Services file similar to the following entries (substituting the appropriate port numbers):

```
shr1    5010/tcp    #Local ODBC Server
shr2    5011/tcp    #Remote SAS/SHARE Server
```

Note: In the case of **`shr2`**, the administrator of the remote system named **`machine`** should have already edited the Services file on that system to include the same **`shr2`** entry and should have started the SAS/SHARE server. △

Other Important Usage Information

Using Data Sets That Have One-Level Names

If you use an ODBC application such as Microsoft Access that exports databases using one-level names, you should use the ODBC administrator to define a USER library. SAS usually places any data set that has a one-level name into the WORK library, which is deleted at the end of the SAS session. But if a USER library has been defined, SAS places all one-level name data sets into the USER library, which is saved at the end of the SAS session. In a multi-user environment, multiple client connections to a SAS server can each have their own USER library defined.

Updating Attached Tables

Some Microsoft products that are based on the JET engine (such as Microsoft Access) have certain requirements in order to be able to update database tables. This might be true of other ODBC applications as well. These requirements might make it necessary for you to specify two SQL options when you define your SAS data sources.

- □ The attached table must have a unique primary key that is not a floating-point value. You can use the Data Source SQL Option **`Infer INTEGER from FORMAT`** to indicate that SAS numeric fields without fractional parts (for example, FORMAT(n,0) where n is less than 12) are actually integer values that can be used to index the table.

- All of the values in a row might be used to uniquely select the row for updating. This can be a problem in rows that contain floating-point fields (SAS numerics). Insignificant differences in values can be caused either by differences in floating-point representation on different machines or by conversion between character and binary formats. By specifying the Data Source SQL Option **`Fuzz Numbers at 12 places`**, you can cause WHERE clauses to select values that are “acceptably close” rather than requiring exact comparisons.

See “Setting Up Your Data Source” on page 14 and “User-Specified SQL Options” on page 40 for more information about these SQL options.

Using SQL Statements to Access SAS Data Sources

All applications that are ODBC compliant use a variety of the Structured Query Language (SQL) to access and manipulate data. However, most of these applications transform your actions into SQL statements so that you do not need to know anything about SQL.

If your application requires you to use SQL statements, or if you use SQL out of personal preference, then you should refer to the chapter “The SQL Procedure” in *Base SAS Procedures Guide*. The elements of SQL grammar that are supported by the SAS ODBC driver are the same as those described in that book.

Accessing the SAS Libraries MAPS, SASUSER, and SASHELP

By default, every SAS session (including SAS server sessions) provides access to the SAS libraries MAPS, SASUSER, and SASHELP. However, because these libraries contain sample data sets and other files that are generally not of interest to ODBC users, the SAS ODBC driver does not report the contents of these libraries when it invokes a SAS ODBC server. (From a programming standpoint, when SQLTables, SQLStatistics, or SQLColumns is called, the result set that is returned does not include rows for the SAS libraries MAPS, SASUSER, or SASHELP.) If you want information from these libraries, you can do either of the following tasks:

- Use a LIBNAME statement to define the desired SAS library to the server.
- Use the SAS ODBC Driver Configuration dialog boxes to define the desired library to your ODBC applications.

In both cases you must use a different name (that is, not MAPS, SASUSER, or SASHELP) as your libref or library name.

Encrypting Passwords

The SAS ODBC driver automatically encrypts passwords in the server definitions that are stored in your system. However, server definitions created before Release 8.1 contain unencrypted passwords. When you install the driver, the program sets up a pwdlog.txt file that lists server definitions that contain unencrypted passwords. You should refer to this file to update your server definitions.

The SAS ODBC driver will display a warning message that the password for a server definition contains an unencrypted value when you

- □ update a server definition that contains an unencrypted password. The warning message appears when you select OK on the Servers page. You will not receive this message again if passwords are properly updated in the server definition.
- □ use a server definition with an unencrypted password in an ODBC application. The warning message appears when you connect to the server. You will continue to receive this message until you have updated passwords in the server definition.

For instructions on how to encrypt passwords in an older server definition, see the discussion of updating an unencrypted password in the online Help of the SAS ODBC Driver Configuration dialog box.

Return Codes and Associated Messages

The SAS ODBC driver uses standard ODBC return codes to notify you of any errors and to provide additional information or warnings. The associated message texts might be generated by the driver itself, by the SAS server, or by your communications access method. See *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide* and Appendix 1, "Return Codes and Associated Messages," on page 45 for explanations of these return codes and their associated texts.

CHAPTER 4

Programmer's Reference

Introduction to the Programmer's Reference

This chapter is intended for applications programmers and others who need information about how the SAS ODBC driver has been implemented. It provides information about the driver's support for ODBC functions, SQL grammar, and SQL data types.

For complete information about the ODBC standard, see *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide*.

Support for and Implementation of ODBC Functions

Microsoft's ODBC specification defines three levels of support for ODBC functions: CORE, LEVEL 1, and LEVEL 2. The SAS ODBC driver is ODBC 2.0 compliant and supports LEVEL 1 functionality, with the exception of those functions associated with cursors (SQLGetCursorName, SQLSetCursorName) and large data fields (SQLParamData, SQLPutData), which are not supported.

The following tables provide explanations of the functions that are not supported or whose implementation details might be noteworthy to applications developers.

CORE Functions

Table 4.1 CORE Functions

Function Name	Purpose	SAS ODBC Driver Implementation
SQLBindParameter	Assigns storage for a parameter in an SQL statement	Note that SQL_DATA_AT_EXEC is not supported because SAS does not support large data fields.
SQLCancel	Cancels an SQL statement	This function is used only in asynchronous mode, which SAS does not support. SAS' interprocess communication library does not provide any way to interrupt a transaction in process. SQLCancel does not cause an active statement to terminate immediately, and it does not halt an operation that is already in process. This is allowable within the function specification. This call always returns as successful.
SQLColAttributes	Describes the attributes of a column in the result set	A common reason for applications to call this function is to determine whether a column of data is a dollar amount. With SAS data sets or views, this is inferred from the FORMAT. See "Supported Data Types" on page 37 for more information about SAS FORMATs.
SQLGetCursorName	Returns the cursor name that is associated with a statement handle	SAS does not support cursors, so this function returns SQL_ERROR with SQLSTATE set to IM001 ("Driver does not support this function").
SQLPrepare	Prepares an SQL statement for later execution	Does not check syntax at this point; syntax checking is done later in the SQLExecute call by the server.
SQLSetCursorName	Specifies a cursor name	SAS does not support cursors, so this function returns SQL_ERROR with SQLSTATE set to IM001 ("Driver does not support this function").
SQLTransact	Commits or rolls back a transaction	Always returns SQL_SUCCESS for SQL_COMMIT. Returns an error for SQL_ROLLBACK because SAS does not support transactions.

LEVEL 1 Functions

Table 4.2 LEVEL 1 Functions

Function Name	Purpose	SAS ODBC Driver Implementation
SQLColumns	Returns the list of column names from specified tables	SAS uses a specially formatted query to query the virtual table DICTIONARY.COLUMNS.
SQLDriverConnect	Connects to a specific driver by connection string or requests that the Driver Manager and the driver display connection dialog boxes for the user	SAS makes use of the same dialog boxes that are used in configuration. If input was adequate, it continues with the connection rather than saving the parameters. However, in many cases input is not required. The connection to the host is made at this time.
SQLGetData	Returns result data for a single unbound column in the current row. The application must call SQLFetch or SQLExtendedFetch prior to calling SQLGetData	This function enables you to use multiple calls to retrieve data in parts from character variables. Some applications need this functionality to access long character variables. The extension SQL_GD_BLOCK (see SQL_GETDATA_EXTENSIONS under SQLGetInfo) is not supported; this means that you can only call SQLExtendedFetch with a rowset size of 1.
SQLParamData	Returns the storage value that has been assigned to a parameter for which data will be sent at execution time	This function is used for large data fields, which SAS does not support, so the function returns SQL_ERROR with SQLSTATE set to IM001 ("Driver does not support this function").
SQLPutData	Sends part or all of a data value for a parameter	This function is used for large data fields, which SAS does not support, so the function returns SQL_ERROR with SQLSTATE set to IM001 ("Driver does not support this function").
SQLSpecialColumns	Retrieves information about the optimal set of columns that uniquely identifies a row in a specified table, or about the columns that are automatically updated when any value in the row is updated by a transaction	The SAS ODBC driver uses a query on the DICTIONARY.INDEXES view to obtain this information.

Function Name	Purpose	SAS ODBC Driver Implementation
SQLStatistics	Retrieves statistics about a single table and the list of indexes that are associated with the table	The SAS ODBC driver uses a query on the DICTIONARY.INDEXES view to obtain this information.
SQLTables	Returns the list of table names stored in a specific data source	The SAS ODBC driver uses a query on the DICTIONARY.TABLES and DICTIONARY.MEMBERS views to obtain this information.

ODBC Cursors and the SQLExtendedFetch Function

The SAS ODBC driver supports the SQLExtendedFetch function to retrieve multiple rows of result data in a single operation. However, SAS does not support real cursor functionality, so the driver cannot truly support cursors.

The implementation of SQLExtendedFetch uses a forward-only cursor to support the syntax of the function. Rows in the result data cannot be skipped, so the parameter *irow* (which is the number of the row to begin fetching) is ignored. You cannot retrieve an arbitrary subset of the result data. However, because a single operation can fetch multiple rows, there is less overhead compared to when you use multiple calls to the SQLFetch function.

Note: In order to support the SQLExtendedFetch function, the SQLSetSmtOption function allows you to set the rowset size and to select row-wise or column-wise binding. △

For additional information about the SQLExtendedFetch function, see *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide*.

Catalog Functions

You might want to eliminate certain SAS librefs from the results of the catalog functions such as SQLColumns, SQLStatistics, SQLSpecialColumns, and SQLTables. Many client applications (for example, Microsoft Access) use these catalog functions to present a list of available tables. Currently, the results from the catalog functions filter out the MAPS, SASHELP, and SASUSER librefs. The filtering is done primarily so those unwanted tables do not appear in lists based on results from these catalog functions. The filtering can also improve the performance of these functions.

You can replace this filter by adding the LibWhere key to an appropriate data source entry in the system Registry. The LibWhere key includes a logical expression to conditionally specify which results to retrieve from the SAS server. The current filter uses the following logical expression:

```
tbl.libname NE 'MAPS' AND tbl.libname NE 'SASUSER' AND
tbl.libname NE 'SASADMIN' AND tbl.libname NE 'SASHELP'
```

The **tbl** name is critical if you need to construct your own in these functions.

CAUTION:
When you use the Registry Editor, you can damage the Windows environment if your changes are invalid or if you accidentally delete information. Do not create a filter unless it is absolutely necessary. Editing the Registry can damage registered programs and make them unusable △

If many librefs are defined on a server, but only specific librefs are needed, you can edit the Registry to specify which librefs to access. For instructions on how to edit the

Registry, see the discussion of catalog functions in the online Help of the SAS ODBC Driver Configuration dialog box.

ODBC Scalar Functions

The SAS ODBC driver supports the following ODBC scalar functions:

String Functions:
`ASCII, CHAR, CONCAT, LCASE, LEFT, LTRIM, REPEAT, REPLACE, RTRIM, SOUNDEX, SPACE, SUBSTRING, UCASE`

Numeric Functions:
`ABS, ACOS, ASIN, ATAN, CEILING, COS, EXP, FLOOR, LOG, LOG10, MOD, POWER, RAND, ROUND, SIGN, SQRT, TAN`

Timedate Functions:
`CURDATE, CURTIME, DAYNAME, DAYOFMONTH, DAYOFWEEK, DAYOFYEAR, HOUR, MINUTE, MONTH, MONTHNAME, NOW, QUARTER, SECOND, YEAR`

The ODBC **`RAND`** scalar function is translated to a SAS function. For more information about the usage and parameters of ODBC scalar functions, consult *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide*.

Support for SQL Grammar

Microsoft's ODBC specification defines three levels of support for SQL grammar: MINIMUM, CORE, and EXTENDED. The SAS ODBC driver supports all of MINIMUM and some of the CORE SQL statements and the statement elements. See *Base SAS Procedures Guide* for complete information about supported grammar.

Currently the SAS ODBC driver does not support the following SQL syntax:

```
SELECT FOR UPDATE OF
```

Records are locked during data manipulation operations but cannot be explicitly locked prior to such an operation.

Supported Data Types

Internally, SAS supports two data types for storing data:

CHAR	fixed-length character data, 32767 character maximum
NUM	double-precision floating-point number

Note: If the data field is longer than 254 characters, this will surface through ODBC with the ODBC data type SQL_VARCHAR. △

By using SAS *format* information, the SAS ODBC driver is able to represent other ODBC data types, both when responding to queries and in CREATE TABLE requests. (A SAS format is a string that describes how data should be printed. SAS associates format information with each column in a table.)

The following sections explain conventions for data type representation that the SAS ODBC driver follows.

For information about user-specified SQL options that can also affect data type representations, see "User-Specified SQL Options" on page 40. For more information about SAS formats, see *SAS Language Reference: Dictionary*.

ODBC SQL Data Types

The SAS ODBC driver supports the ODBC SQL types listed below. Internally, SAS supports a numeric and character data type using a variety of informats and formats to modify the data representation. The SAS ODBC driver uses the informat and format to determine the corresponding ODBC data type:

SQL Data Type	SAS ODBC Driver Implementation
SQL_CHAR.	Supports text fields up to 200 characters long.
SQL_VARCHAR.	Interpreted for text columns of length 80 or greater when the Support Varchar option is enabled from the SQL Options section of the SAS ODBC Driver Configuration dialog box. The maximum length of an SQL_VARCHAR field is 32,767 characters, available when the version of the SAS server is Version 7 or later. For SAS Version 6 servers, the SQL_VARCHAR field is limited to 200 characters.
SQL_DOUBLE.	1.E-308 to 1.E308
SQL_FLOAT.	1.E-308 to 1.E308
SQL_INTEGER.	-2,147,483,648 to 2,147,483,647
SQL_DATE.	Valid dates range from 1582 A.D. to 9999 A.D.
SQL_TIME.	ODBC supports time values within the range of a 24-hour day (00:00:00 to 3:59:59).
SQL_TIMESTAMP.	Valid dates range from 1582 A.D. to 9999 A.D. with a 24-hour day (00:00:00 to 23:59:59) time portion.

Data Types Reported on Queries

When the SQLDescribeCol and SQLColAttributes functions are called against active queries, the SAS ODBC driver reports data types as follows:

- When the SQLDescribeCol function is called, the SAS ODBC driver reports CHAR data types as SQL_CHAR. NUM data types are generally reported as SQL_DOUBLE.

  However, SAS stores dates and times as numbers, and the SAS ODBC driver uses SAS format information to infer the following additional SQL data types from NUM data types:*

* For a complete list of date and time formats that the SAS ODBC driver supports, see the table of formats listed by categories in *SAS Language Reference: Dictionary*.

SAS Data Type	SQL Data Type
NUM FORMAT=DATE*n*.	SQL_DATE
NUM FORMAT=TIME*n*.	SQL_TIME
NUM FORMAT=DATETIME*n*.	SQL_TIMESTAMP

In each of the previous FORMAT= strings, *n* is a number that selects the printable representation by specifying a width for printing. The value of *n* is not relevant to the driver.

- When the SQLColAttributes function is called, if a NUM column has a format of DOLLAR*n*., the SAS ODBC driver identifies it as financial data (having a column attribute of SQL_COLUMN_MONEY).

Retrieving Native SAS Format Information

You can find the SAS format for a particular column by using the SQLColumns function. The SAS ODBC driver returns the additional column FORMAT. The 13th column in the result set that the SQLColumns function returns contains a string with the format information for a SAS column of data.

Creating or Comparing Date, Time, and Datetime Values

When you create or compare date, time and datetime values in SAS data sets from an ODBC application, you must consider the following:

- A SAS time value is the number of seconds since the current day began. That is, 0 is 00:00:00 or 12:00:00 AM and 86399 is 11:59:59 PM.

  Note: ODBC does not support negative time values or values greater than one day's worth of seconds. The SAS ODBC driver returns an error for time values that are less than 0 or greater than 86399 (the last second of the day). △
- A SAS date value is the number of days since January 1, 1960. That is, 0 is 01jan1960 and -1 is 31dec1959.
- A SAS datetime value is the number of seconds since midnight on January 1, 1960. That is, 0 is 01jan1960:00:00:00 and -1 is 31dec1959:11:59:59.

Both ODBC and SAS date, time and datetime literals are supported by the SAS ODBC driver.

CAUTION:

You can only compare equivalent literals against SAS date, time or datetime values since they each have a different unit of measure. △

For example, you cannot compare a SAS data set value that has been defined with a datetime format against a date literal using

```
select * where hiredate = {d'1995-01-02'}
```

or

```
select * where hiredate = '02jan1995'd
```

Instead, use a datetime literal such as

```
select * where hiredate = {ts'1995-01-02 00:00:00'}
```

```
or
   select * where hiredate = '02jan1995:00:00:00'dt
```

Interpreting Data Types in CREATE TABLE Requests

In CREATE TABLE requests, the SAS ODBC driver interprets certain column-type specifications by creating NUM variables and associating SAS formats with them, as shown in the following table:

Table 4.3 Correspondence of CREATE TABLE Data Types and SAS Data Types

CREATE TABLE Data Type Name	ODBC Data Type	SAS Data Type
char(*w*)	SQL_CHAR	CHAR(*w*)
num(*w*, *d*)	SQL_DOUBLE	NUM
num(*w*, *d*)	SQL_FLOAT	NUM
integer	SQL_INTEGER	NUM FORMAT=11.0
date9x	SQL_DATE	NUM FORMAT=DATE9.
datetime19x	SQL_TIMESTAMP	NUM FORMAT=DATETIME19.
time8x	SQL_TIME	NUM FORMAT=TIME8X

The data type names listed in the first column of the table are the values that are returned by SQLColAttributes (with the parameter SQL_COLUMN_TYPE_NAME) and by SQLGetTypeInfo. For all CREATE TABLE statements, the SAS ODBC driver translates these data type names into the respective SAS data types shown under the SAS Data Type heading. Do not try to use the ODBC data types directly in SAS.

In a CREATE TABLE statement, any FORMAT= specification is passed on to SAS unmodified, so a column within a table (or data set) can be created according to any exact specification that is required for its use within SAS. For example, in the following CREATE TABLE statement, variable **B**'s data type and format are passed directly to SAS.

```
CREATE TABLE
   SASUSER.TABLE1
      (A INTEGER,
       B NUM FORMAT=9.5,
       C CHAR(40) );
```

User-Specified SQL Options

This section describes two SQL options that affect how other default conversions of data types or data values can be made: **Infer INTEGER from FORMATS** and **Support VARCHAR**. The SQL option **Disable _0 override parsing** will prevent a SAS error by ensuring that the SAS ODBC driver keeps the _0 string at the end of a table name. **Fuzz Numbers at N Places** is important in comparison operations. You can specify these SQL options on the General page of the SAS ODBC Driver Configuration dialog box. (See "Setting Up Your Data Source" on page 14.)

Infer INTEGER from FORMAT Option

Even when no FORMAT string is specified for SAS data, SAS assigns a default width and number of decimal places to the data. If the SQL Option **`Infer INTEGER from FORMAT`** is selected, then the SAS ODBC driver reports SAS columns of NUM(*n*,0) data types as SQL_INTEGER, where *n* is less than 12. This can be important, because some PC products do not use indexes on floating-point columns. If those columns actually contain only integer values, then using this option enables these products to honor the index and allow updates. See "Updating Attached Tables" on page 30 for more information.

Support VARCHAR Option

The SQL option **`Support VARCHAR`** causes the SAS ODBC driver to report the data type CHAR(*n*) as SQL_VARCHAR, where *n* is greater than 80. Because SAS is fixed width, CHAR fields are often specified at the maximum. For example, for a list of messages the text width might be specified as 200 characters, even though the average width is much less. Reporting it as SQL_VARCHAR enables some PC products to use less memory.

Disable _0 override parsing Option

Sometimes the _0 string occurs at the end of names in SQL queries constructed by certain applications. For example, the string _0 is added to table aliases in SQL queries that MS Query constructs so that the table name **`mytable`** becomes **`mytable_0`**. This table name is nine characters in length, which SAS Version 6 cannot handle because table names are limited to eight characters.

To prevent a SAS error, the SAS ODBC driver removes the _0 string found in the eighth or greater position of a table name. However, if SAS variable names contain the _0 string at the eighth or greater position, a query might not execute properly. A variable name such as aaaaaa_0 will not cause a problem but variable names such as aaaaaaa_0 and aaaaaaaa_0 will cause SAS errors. The SQL option **`Disable _0 override parsing`** prevents the SAS ODBC driver from removing the _0 string.

Note: You can use this option if the data on your SAS server has been created with Version 7 or later of the ODBC server, and you are running Version 7 or later of the SAS server. This is because Version 7 can handle table names and variable names up to 32 characters in length. If your SAS server is Version 6, or if you use Version 7 or later of the ODBC server to access data in Version 6 format, parsing errors might occur depending on the length of your table names, or whether the _0 string exists in a variable name. △

Fuzz Numbers at N Places Option

This option addresses a problem that arises from the conversion of floating-point numbers. Floating-point numbers are stored in different binary representations on different computer hardware. Even when data is transferred between different applications on the same type of hardware, the precision of floating-point numbers might be affected slightly due to conversion between ASCII and binary representations.

This effect is usually so slight that it is insignificant when a number is used in calculations. For example, the numbers 65.8 and 65.799999999999 are practically identical for mathematical purposes, and the difference between them might be the result of conversion between representations rather than any purposeful change in value.

However, such a slight difference in value can keep a number from comparing correctly. For example, many ODBC applications include a WHERE clause that lists every column in a record at its current value whenever the application performs an UPDATE. This is done to ensure that the record has not been changed since the last time it was read. Sometimes a comparison might fail because of the aforementioned problem with floating-point conversion.

To solve this problem, SAS "fuzzes" numbers (standardizes the degree of precision to use, overriding the hardware-specific representations). Instead of using exact comparisons, SAS checks to make sure that the numbers are acceptably close.

By default, the degree of precision is 12 decimal places. Given a number **N**, if **N1** were to be checked for equality with **N**, then the SAS ODBC driver would use the SQL BETWEEN function to determine whether **N1 > (N - (ABS(N * 10**-12))) AND N1 < (N + (ABS(N * 10**-12)))**.

If **N=0**, the driver checks for **BETWEEN -(10**-12) AND (10**-12)**.

Security Notes on Windows NT, Windows 2000, and Windows XP

You can set up a secure SAS/SHARE server on Windows NT, Windows 2000, and Windows XP. To specify a secure SAS/SHARE server, you submit code similar to the following code on your Windows system:

```
/* Start a remote secured SAS/SHARE server that requires user login  */
/* name and password specified by the client.                        */
/* ADOMAIN is the NT domain that authenticates username and password */
%let tcpsec=_secure_;           /* Require user loginid/password  */
options authserver=adomain;
proc server id=shr1 authenticate=req;
run;
```

However, for this program to work you must assign **Act as part of the operating system** rights to the user account that is running the SAS/SHARE server. You must also assign **Log as a batch job rights** to the account that wants to connect to the SAS/SHARE server.

For example, suppose your Windows system is named **TRISTAN**, and the user account **adomain\stephmc** wants to connect to the SAS/SHARE server. Also, suppose the user logged in to **TRISTAN** (and running the SAS/SHARE server) is the user account **adomain\joshua**. On the system named **TRISTAN**, you must assign the user rights. For Windows NT or Windows 2000, use the utility **User Manager or User Manager for Domains**. For Windows XP, use the **group policy**.

For Windows NT or Windows 2000 complete the following steps:

1 **Start --> Programs --> Administrative Tools --> User Manager**.

2 Select **User Rights...** from the Policies menu.

3 Select **Show Advanced User Rights**.

4 Grant **Act as part of the operating system rights** to **adomain\joshua**.

5 Grant **Logon as a batch job** rights to **adomain\stephmc**.

For Windows XP, complete the following steps:

1. Select **`Start --> Run`**, type **`gpedit.msc`**, and then click $\boxed{\text{OK}}$.
2. Select **`Windows Settings`** from Computer Configuration. Select **`Security Settings`**, **`Local Policies`**, and **`User Rights Assignment`**.
3. Right-click **`Act as part of the operating system`** and then select **`Properties`**. Select **`Add User or Group`**, type **`adomain\joshua`**, and then click $\boxed{\text{OK}}$.
4. Right-click **`Log on as a batch job`** and then select **`Properties`**. Select **`Add User or Group`**, type **`adomain\stephmc`**, and then click $\boxed{\text{OK}}$.

After the system **`TRISTAN`** is shut down and restarted (rebooting is usually required), you submit the above SAS/SHARE code on **`TRISTAN`**.

To log on to the remote Windows system, the user account **`adomain\stephmc`** specifies the user name **`adomain\stephmc`** in the SAS ODBC Driver Configuration dialog box and the password in the SAS/SHARE Options dialog box. The user will also specify an address such as **`tristan.mynet.com`**. This will enable the user account **`adomain\stephmc`** to connect to the secure SAS/SHARE server.

This information is also documented in *SAS/SHARE User's Guide*.

SAS ODBC Driver Error Codes

See *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide* for information about the SQLSTATE values (return codes) and associated texts that can be returned for the SQLError function.

For explanations of messages that might be returned by your communications software, see Appendix 1, "Return Codes and Associated Messages," on page 45.

APPENDIX 1 Return Codes and Associated Messages

SAS ODBC Driver Return Codes

See the *Microsoft ODBC 2.0 Programmer's Reference and SDK Guide* for information about the SQLSTATE values (return codes) and the associated text that can be returned for the SQLError function. The messages might be generated by the driver itself, by the SAS server, or by your communications software. The ODBC Driver Manager passes these codes and messages on to client applications.

S1000 Communications Access Method Errors

The S1000 (SAS API Error) return code is often accompanied by error messages that are returned by your communications software. The following tables list some of these message texts and provide explanations for them.

In addition to these error messages and return codes, some additional information can sometimes be found in a "trace" file that is created in the working directory of the ODBC client application that fails a connection to a SAS server. This trace file has the name **`WQE`*`xxxxx`*`.TRC`**, where *xxxxx* is the process ID of the ODBC client application at the time of failure.

Table A1.1 S1000 Communication Access Method Errors

Message Text	Explanation
Memory failure	Not enough memory is available.
Network failure	An unspecified network failure occurred.
No server found	The remote server was not found.
Remote closed connection	The SAS server disconnected.
Remote refused connection	The remote system disallowed a connection. Check the remote services file.
Start SAS failure—please check your SAS server parameters	The ShellExecute statement failed when starting SAS. Check to see whether the SAS paths are specified properly.

Message Text	Explanation
TCP method Winsock API <*function-name*> failed with WSAGetLastError <*rc*>	A TCP/IP Winsock return code (*rc*) was returned. Even though it is impossible to document all the possible reasons you might get one of these return codes, they are listed in Table A1.2 on page 46 to provide some indication of where the Winsock transport is having a problem.
Timeout waiting for the SAS server—check the startup options	A SAS server did not register itself as a server within the specified time period.
Unable to locate remote host	TCP/IP could not find the remote host name.
Unable to locate service	TCP/IP could not find the server name in the services file.
Userid.password security failure	User ID and password verification failed on the remote machine.
You must connect to SAS/SHARE on a remote machine	You must select the SAS/SHARE button on the SAS ODBC Servers page (Display 2.4 on page 16) in order to connect to a remote machine.

TCP/IP Winsock Return Codes

Table A1.2 TCP/IP Winsock Return Codes

Return Code	Return-Code Mnemonic	Description
10004	WSAEINTR	The (blocking) call was canceled via WSACancelBlockingCall.
10013	WSAEACCES	The requested address is a broadcast address, but the appropriate flag was not set.
10014	WSAEFAULT	The function argument is incorrect.
10022	WSAEINVAL	Invalid argument or function sequence or the socket has not been bound with bind.
10024	WSAEMFILE	No more file descriptors are available.
10035	WSAEWOULDBLOCK	The socket is marked as non-blocking and the operation would block.
10036	WSAEINPROGRESS	A blocking Windows Sockets call is in progress.
10037	WSAEALREADY	The asynchronous routine being canceled has already completed.
10038	WSAENOTSOCK	The description is not a socket.
10039	WSAEDESTADDREQ	A destination address is required.
10040	WSAEMSGSIZE	The datagram was too large to fit into the specified buffer and was truncated.
10041	WSAEPROTOTYPE	The specified protocol is the wrong type for this socket.
10042	WSAENOPROTOOPT	The option is unknown or unsupported.
10043	WSAEPROTONOSUPPORT	The specified protocol is not supported.

Return Code	Return-Code Mnemonic	Description
10044	WSASOCKTNOSUPPORT	The specified socket type is not supported in this address family.
10045	WSAEOPNOTSUPP	The referenced socket is not the proper type.
10046	WSAEPFNOSUPPORT	The protocol family is not supported.
10047	WSAEAFNOSUPPORT	The specified address family is not supported.
10048	WSAEADDRINUSE	The specified address is already in use.
10049	WSAEADDRNOTAVAIL	The specified address is not available from the local machine.
10050	WSAENETDOWN	The Windows Sockets implementation has detected that the network subsystem has failed.
10051	WSAENETUNREACH	The network can't be reached from this host at this time.
10052	WSAENETRESET	The connection must be reset because the Windows Sockets implementation dropped it.
10053	WSAECONNABORTED	The virtual circuit was aborted due to time-out or other failure.
10054	WSAECONNRESET	The virtual circuit was reset by the remote side.
10055	WSAENOBUFS	No buffer space is available.
10056	WSAEISCONN	The socket is already connected.
10057	WSAENOTCONN	The socket is not connected.
10058	WSAESHUTDOWN	The socket has been shut down.
10059	WSAETOOMANYREFS	Too many references: can't splice.
10060	WSAETIMEDOUT	Attempt to connect timed out without establishing a connection.
10061	WSAECONNREFUSED	The attempt to connect was forcefully rejected.
10062	WSAELOOP	Too many levels of symbolic links.
10063	WSAENAMETOOLONG	The filename is too long.
10064	WSAEHOSTDOWN	The host is down.
10065	WSAEHOSTUNREACH	No route to host.
10066	WSAENOTEMPTY	The directory is not empty.
10067	WSAEPROCLIM	Too many processes.
10068	WSAEUSERS	Too many users.
10069	WSAEQUOT	The disk quota was exceeded.
10070	WSAESTALE	Stale NFS file handle.
10071	WSAEREMOTE	Too many levels of remote in path.
10091	WSAESYSNOTREADY	The underlying network subsystem is not ready for network communication.
10092	WSASVERNOTSUPPORTED	The version of Windows Sockets API support requested is not provided by this particular Windows Sockets implementation.

Return Code	Return-Code Mnemonic	Description
10093	WSANOTINITIALISED	A successful WSAStartup must occur before using this API.
11001	WSAHOST_NOT_FOUND	Authoritative Answer Host not found.
11002	WSATRY_AGAIN	Non-Authoritative Host not found, or SERVERFAIL.
11003	WSANO_RECOVERY	Non-recoverable errors, FORMERR, REFUSED, NOTIMP.
11004	WSANO_DATA	Valid name, no data record of requested type.

APPENDIX 2 Recommended Reading

Recommended Reading

Here is the recommended reading list for this title:

- *Base SAS Procedures Guide*
- *SAS/ACCESS for PC Files: Reference*
- *SAS/ACCESS for Relational Databases: Reference*
- *SAS Companion for Windows*
- *SAS Language Reference: Concepts*
- *SAS/SHARE User's Guide*

For a complete list of SAS publications, see the current *SAS Publishing Catalog*. To order the most current publications or to receive a free copy of the catalog, contact a SAS representative at

SAS Publishing Sales
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Customers outside the United States should contact their local SAS office.

Glossary

access descriptor
a SAS/ACCESS file that describes data that is managed by a database management system. After creating an access descriptor, you can use it as the basis for creating one or more view descriptors.

application programming interface (API)
a set of software functions that facilitate communication between applications and other kinds of programs, services, or devices.

access method
the communications protocol that the SAS ODBC driver uses to exchange data with a SAS server. The driver currently supports the use of TCP/IP and Network DDE for remote data exchange, and DDE for local exchange.

API
See application programming interface (API).

client
a workstation or application that requests services, data, or other resources from a server.

DBMS
See database management system (DBMS).

database management system (DBMS)
a software application that enables you to create and manipulate data that is stored in the form of databases.

data source name (DSN)
a name that is associated with a data source definition. The data source definition specifies how to locate and access a data source, including any authentication (such as a user name and password) that a user must supply in order to access the data

dialog window
a window that prompts a user for additional information in order to perform a specified action.

driver
See ODBC driver.

DSN
See data source name (DSN).

engine
a component of SAS software that reads from or writes to a file. Each engine enables SAS to access files that are in a particular format. There are several types of engines.

file dsn
a data source name that is stored completely within a file (unlike a user DSN or a system DSN, which are stored in the Windows registry).

libref
a name that is temporarily associated with a SAS data library. For example, in the name SASUSER.ACCOUNTS, the name SASUSER is the libref. You assign a libref with a LIBNAME statement or with an operating system command.

ODBC driver
a loadable library module that provides a standardized interface to disparate databases or data sources.

SPD server
a SAS Scalable Performance Data server. An SPD server restructures data in order to enable multiple threads, running in parallel, to read and write massive amounts of data efficiently.

system DSN
a data source name that can be accessed by any user of the system on which the data source is stored. System DSNs are stored in the Windows registry.

user DSN
a data source name that can be accessed by any user of the system on which the data source is stored. System DSNs are stored in the Windows registry.

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Your Turn

If you have comments or suggestions about *SAS® ODBC Driver 9.1: User's Guide and Programmer's Reference*, please send them to us on a photocopy of this page, or send us electronic mail.

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