**Introduction**

This chapter introduces SAS System users to CA-OpenIngres, a relational database management system (DBMS). It accompanies and should be used with SAS/ACCESS Software for Relational Databases: Reference, First Edition (order #55940).*

This chapter describes the SAS/ACCESS LIBNAME and data set options that are specific to CA-OpenIngres. It then focuses on the terms and concepts that help you use the SAS/ACCESS interface to CA-OpenIngres. Next, it describes the CA-OpenIngres-specific arguments and statements that you use in the ACCESS and DBLOAD procedures and in the SQL procedure's CONNECT statement.

For more information about CA-OpenIngres, refer to your CA-OpenIngres documentation.

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Version 7 Information

This section describes the LIBNAME statement and its options that are specific to CA-OpenIngres. The LIBNAME statement and options that can be used in most databases are fully described in “SAS/ACCESS LIBNAME Statement” on page 24. This section also describes the connection options for CA-OpenIngres.

Dictionary

SAS/ACCESS LIBNAME Statement: CA-OpenIngres Specifics

Associates a SAS libref with a DBMS database, schema, server, or group of tables and views.
Valid: Anywhere

Syntax

LIBNAME libref SAS/ACCESS-engine-name
   SAS/ACCESS-engine-connection-options <SAS/ACCESS-LIBNAME-options>;

Arguments

libref

is any SAS name that serves as an alias to associate the SAS system with a
database, schema, server, or group of tables and views.

SAS/ACCESS-engine-name

is a SAS/ACCESS engine name for your DBMS, in this case, CA-OpenIngres.
SAS/ACCESS engines are implemented differently in different operating
environments. The engine name is required.

SAS/ACCESS-engine-connection-options

are options that you specify in order to connect to a particular database; these
options are different for each database. If the SAS/ACCESS engine connection
options contain characters that are not allowed in SAS names, enclose the values of
the options in quotation marks. On some DBMSs, if you specify the appropriate
system options or environment variables for your database, you can often omit the
SAS/ACCESS engine connection options.

SAS/ACCESS-LIBNAME-options

are options that apply to the objects in a DBMS, such as its tables or indexes. For
example, the SPOOL= option enables you to specify whether or not SAS creates a
utility spool file during read operations. Support for many of these options is DBMS
specific.

Some SAS/ACCESS LIBNAME options can also be specified as SAS/ACCESS
engine data set options. When you specify an option in the LIBNAME statement, it
applies to objects and data that are referenced by the libref. A SAS/ACCESS data set option applies only to the data set on which it is specified. If a like-named option is specified in both the SAS/ACCESS engine LIBNAME statement and after a data set name (which references a DBMS table or view), the SAS System uses the value that is specified after the data set name. Refer to “SAS/ACCESS Data Set Options” on page 39 for more information.

Details

The LIBNAME statement associates a libref with a SAS/ACCESS engine in order to access tables or views in a database management system (DBMS). The SAS/ACCESS engine enables you to connect to a particular DBMS and, therefore, to specify a DBMS table or view name in a two-level SAS name.

For example, in MYLIB.EMPLOYEES_Q2, MYLIB is a SAS libref that points to a particular group of DBMS objects, and EMPLOYEES_Q2 is a DBMS table name. When you specify MYLIB.EMPLOYEES_Q2 in a DATA step or procedure, you dynamically access the DBMS table. Version 7 of the SAS System supports reading, updating, creating, and deleting DBMS tables.

To disassociate or clear a libref from a DBMS, use a LIBNAME statement that specifies the libref (for example, MYDBLIB) and the CLEAR option as follows:

```
libname mydblib CLEAR;
```

The database engine disconnects from the database and closes any free threads or resources that are associated with that connection.

See “SAS/ACCESS LIBNAME Statement” on page 24 for more information on options that you can use in the LIBNAME statement.

SAS/ACCESS Engine Connection Options

The SAS/ACCESS engine connection options for CA-OpenIngres are as follows:

- **USER=** on page 219
- **PASSWORD=** on page 219
- **CONN_OPTIONS=** on page 220
- **DATABASE=** on page 220
- **SCHEMA=** on page 220

- **USER=**username
  
  enables you to connect to a CA-OpenIngres database with a user ID that is different from the default ID.

  The **USER=** and **PASSWORD=** connections are optional in CA-OpenIngres because users have pre-configured userids on their respective nodes. If **USER=** is omitted, your default userid is used.

- **PASSWORD=**password
  
  specifies the password that is associated with a username.
The USER= and PASSWORD= connection options are optional in CA-OpenIngres because users have pre-configured userids on their respective nodes.

**CONN_OPTIONS=connection-options**

specifies optional connection flags to the CA-OpenIngres DBMS. You can use any flag that is valid in CA-OpenIngres SQL. Connection options must be specified in quotation marks and separated by commas.

**DATABASE=database-name**

specifies the name of the CA-OpenIngres database that contains the tables and views that you want to access.

The DATABASE= option is required in order to connect to CA-OpenIngres. If you use a remote database, enter its remote virtual node name. If you use a distributed database, enter the database server type. If you use a remote distributed database, enter the database's virtual node name and server type. Quotation marks are required around the entire database string. The syntax for the database field follows:

<v-node::>database</server—type>

where

- **v-node** is the name of the remote virtual node where the database is located. It implies that the network node address and protocol are defined by the NETU utility provided by CA-OpenIngres. Refer to your CA-OpenIngres administrator’s guide for more information on the NETU utility.

- **database** is the name of the database.

- **server-type** is the type of server that is being accessed at the local or remote site. Valid server types are INGRES for a CA-OpenIngres DBMS server or STAR for a CA-OpenIngres/STAR server. (You can replace /STAR with /D.) If you omit a server type, the default server type, INGRES, for the CA-OpenIngres DBMS, is used.

For example, to access the distributed database called TEXTILE on a remote virtual node named ATLANTA, you would enter ‘ATLANTA::TEXTILE/STAR’.

**SCHEMA=schema-name**

enables you to specify which schema a libref references when you connect to CA-OpenIngres. When SCHEMA= refers to a userid that is different from your default userid, you must have the appropriate GRANT privileges to be able to access tables in that schema.

By default, when you connect to CA-OpenIngres, all tables are referenced by using your default schema.

**SAS/ACCESS LIBNAME Options**

This section describes the LIBNAME statement and its options that are specific to CA-OpenIngres. The LIBNAME statement and options that can be used in most databases are fully described in “SAS/ACCESS LIBNAME Statement” on page 24. The SAS/ACCESS LIBNAME options for CA-OpenIngres are as follows:

- **DBINDEX=** on page 221
- **PREVERSE_COL_NAMES=** on page 221
- **PREERVE_TAB_NAMES =** on page 221
SPOOL= on page 221

DBINDEX=YES|NO

indicates whether or not SAS calls CA-OpenIngres to find all indexes on the specified table.

The default value for CA-OpenIngres is NO. For a full description of this option, refer to “SAS/ACCESS LIBNAME Statement” on page 24.

PRESERVE_COL_NAMES=YES|NO

preserves spaces, special characters, and mixed case in CA-OpenIngres column names if the database was created with the ANSI/ISO Entry SQL-92 setting. Otherwise, PRESERVE_COL_NAMES= only preserves special characters and does not preserve case.

The default value for PRESERVE_COL_NAMES= for CA-OpenIngres is NO because CA-OpenIngres is a case-insensitive DBMS. For a full description of this option, refer to “SAS/ACCESS LIBNAME Statement” on page 24.

PRESERVE_TAB_NAMES=YES|NO

preserves spaces, special characters, and mixed case in CA-OpenIngres table names if the database was created with the ANSI/ISO Entry SQL-92 setting. Otherwise, PRESERVE_TAB_NAMES= only preserves special characters and does not preserve case.

The default value for PRESERVE_TAB_NAMES= for CA-OpenIngres is NO because CA-OpenIngres is a case-insensitive DBMS. For a full description of this option, refer to “SAS/ACCESS LIBNAME Statement” on page 24.

SPOOL=YES|NO

specifies whether or not SAS creates a utility spool file during read operations that are performed with the specified LIBNAME.

If you omit SPOOL=, the default value is SPOOL=YES. For a full description of this option, refer to “SAS/ACCESS LIBNAME Statement” on page 24.

Example: Specifying a LIBNAME Statement to Access CA-OpenIngres Data

In this example, the libref MYLIB uses the CA-OpenIngres engine to connect to a CA-OpenIngres database. The SAS/ACCESS engine connection options are USER=, PASSWORD=, DATABASE=, CONN_OPTIONS=, and SCHEMA=.

```
libname mylib ingres
  user=testuser password=testpass
  database=testdatabase
  conn_options="-xw"
  schema=testschema;
proc print data=mylib.staff;
  where state='CA';
run;
```
See Also

SAS/ACCESS Data Set Options: CA-OpenIngres Specifics

This section describes options that can be applied to SAS data sets that access data in CA-OpenIngres tables and views. In some cases, the option is fully described in “SAS/ACCESS Software for Relational Databases,” except for some CA-OpenIngres-specific detail, such as a default value. In other cases, the entire option is CA-OpenIngres specific, so it is fully described in this chapter.

When specified in a DATA step or SAS procedure, the following data set options can be used on a SAS data set that accesses data in a DBMS object, such as a table or view. A data set option applies only to the SAS data set, or DBMS object, on which it is specified.

The SAS/ACCESS data set options for CA-OpenIngres are as follows:
- `DBINDEX=` on page 222
- `DBNULL=` on page 222
- `DBTYPE=` on page 223
- `SASDATEFMT=` on page 223
- `SCHEMA=` on page 223

**DBINDEX=**

Indicates whether or not SAS calls CA-OpenIngres to find index(es) on the specified table.

Default value: NO

**Syntax**

`DBINDEX=YES | NO | <index-name>`

**See Also**

`DBKEY=`

For a full description of this option, refer to “`DBINDEX=`” on page 44.

**DBNULL=**

Indicates whether or not NULL is a valid value for the specified variables or columns.

Default value: NO
### Syntax

**DBNULL**=(variable1=YES | NO column1=NO | YES)

For a full description of this option, refer to “DBNULL=” on page 47.

---

**DBTYPE**=

Specifies whether or not to override the default CA-OpenIngres data type(s) when SAS outputs data to DBMS tables.

**Default value:** CHAR( ), FLOAT

**Syntax**

DBTYPE=(variable-name1=DBMS-type <...> <variable-name-n=DBMS-type>)

For a full description of this option, refer to “DBTYPE=” on page 49.

---

**SASDATEFMT**=

Changes the SAS date format or informat of a CA-OpenIngres column.

**Default value:** DATETIME16.

**Syntax**

SASDATEFMT=(DBMS-date-col='SAS-date-(in)format' ...)

SASDATEFMT= can also be specified with the SASDATEINFMT alias. For a full description of this option, refer to “SASDATEFMT=” on page 52.

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**SCHEMA**=

Enables you to read database tables and views in the specified schema.
Default value: None

Syntax

SCHEMA=schema-name

If you have READ access to tables and views in another schema, you can use the SCHEMA= data set option to browse them. SCHEMA= can also be specified with the OWNER= alias.

SAS System Option for the Interface to CA-OpenIngres

When you use PROC ACCESS and PROC DBLOAD, you can still use the INGOPTS= system option to pass certain flags to the DBMS to override the default action. To pass these flags to the LIBNAME engine, you must use the CONN_OPTIONS=LIBNAME option. For a description of CONN_OPTIONS=, refer to CONN_OPTIONS= on page 220.

By default, CA-OpenIngres ignores exceptions and does not issue errors or warnings when arithmetic exceptions occur. By using the INGOPTS= option, you can specify whether you want exceptions handled as errors or warnings. The SAS/ACCESS interface view engine for CA-OpenIngres only supports the arithmetic handling mode flag -xk, where k can either be an f (fatal error) or a w (warning).

INGOPTS="INGARITH=-xf"

handles exceptions as errors and the transaction is not completed.

INGOPTS="INGARITH=-xw"

handles exceptions as warnings and the transaction is completed. This is the default action.

The INGOPTS= option can be included in a SASV7.CFG file, submitted on the SAS command line, or submitted from within the SAS System. For more information about options that set the arithmetic handling modes, refer to your CA-OpenIngres SQL reference manual.

ACCESS Procedure: CA-OpenIngres Specifics

The following section describes the DBMS-specific statements that you use in the SAS/ACCESS interface to CA-OpenIngres.

ACCESS Procedure Statements for CA-OpenIngres

To create an access descriptor, you use a database-description statement in the PROC ACCESS step, DATABASE=. The database-description statement supplies database-specific information to the SAS System. This statement must immediately follow the CREATE or UPDATE statement that specifies the access descriptor to be created or updated.
Database-description statements are required only when you create access
descriptors. Because CA-OpenIngres information is stored in an access descriptor, you
do not need to repeat this information when you create view descriptors.
The syntax for other statements that you use to create an access descriptor is
provided below.

Note: The SAS/ACCESS interface to CA-OpenIngres does not use the following
procedure statements: USER= and PASSWORD=.

The SAS/ACCESS interface to CA-OpenIngres uses the following procedure
statements in interactive line, noninteractive, or batch mode:

**PROC ACCESS** <DBMS=INGRES| view-descriptor-options>;

CREATE libref.member-name.ACCESS| VIEW;
UPDATE libref.member-name.ACCESS| VIEW;
DATABASE = '<v-node::>database</server-type>';
TABLE = '<table-name'>;
ASSIGN <==> YES|NO;
DROP '<column-identifier-1>' ... '<column-identifier-n>';  
FORMAT '<column-identifier-1>' <= 'SAS-format-name-1'  
     ... '<column-identifier-n>' <= 'SAS-format-name-n';  
QUIT;
RENAME '<column-identifier-1>' <= 'SAS-variable-name-1'  
     ... '<column-identifier-n>' <= 'SAS-variable-name-n';
RESET ALL| '<column-identifier-1>' ... '<column-identifier-n>';  
SELECT ALL| '<column-identifier-1>' ... '<column-identifier-n>';  
SUBSET selection-criteria;
UNIQUE <==> YES|NO;
LIST <ALL| VIEW| '<column-identifier'>>

**RUN**;

DATABASE = '<v-node::>database</server-type>';  

The DATABASE = statement specifies the name of the CA-OpenIngres database.
This statement is required.

If you use a remote database, you enter its remote virtual node name. If you
use a distributed database, you enter the database server type. If you use a
remote distributed database, you enter the database virtual node name and server
type. The syntax for the database field follows; quotes are required around the
entire database string:

'<v-node::>database</server-type>'

where
v-node is the name of the remote virtual node where the database is
located. It implies that the network node address and protocol
are defined by the NETU utility that is provided by
CA-OpenIngres. For more information about the NETU utility,
refer to your CA-OpenIngres/Net user’s and administrator’s
guide.
database is the name of the database.
server-type is the type of server that is being accessed at the local or
remote site. Valid server types are **INGRES** for a CA-OpenIngres
DBMS server or STAR for a CA-OpenIngres/Star server. (You can replace /STAR with its alias, /D.) If you omit a server type, the default server type, INGRES, for the CA-OpenIngres DBMS is used.

For example, to access the distributed database called TEXTILE on a remote virtual node named ATLANTA, you would enter ‘ATLANTA::TEXTILE/STAR’.

```
proc access dbms=ingres;
  /*create access descriptor */
  create adlib.customer.access;
  database='testnode::testdatabase/star';
  table=customers;
  assign=yes;
  rename customer = custnum;
  format firstorder date9.;
  list all;

  /*create usacust view */
  create vlib.usacust.view;
  select customer state zipcode name
    firstorder;
  subset where customer like '1%';
run;
```

DBLOAD Procedure: CA-OpenIngres Specifics

The following section describes the DBMS-specific statements that you use in the SAS/ACCESS interface to CA-OpenIngres.

DBLOAD Procedure Statements for CA-OpenIngres

To create and load a CA-OpenIngres table, use the DBMS=INGRES option and one database-description statement in the PROC DBLOAD step, DATABASE=. The database-description statement supplies database-specific information to the SAS System.

The syntax for other statements that you use to create and load a CA-OpenIngres table is provided below.

Note: The SAS/ACCESS interface to CA-OpenIngres DBLOAD procedure does not use the following procedure statements: USER= and PASSWORD=.

The SAS/ACCESS interface to CA-OpenIngres DBLOAD procedure uses the following statements in interactive line, noninteractive, or batch mode:

**PROC DBLOAD**<DBMS=INGRES> <DATA=<libref.> SAS-data-set> <APPEND>;
  DATABASE='<v-node::>database<server-type>'
  TABLE=<'table-name'>
  ACCDESC=<libref.>access-descriptor;
PROC DBLOAD Options

APPEND

enables you to load SAS data set observations into an existing CA-OpenIngres table, beginning with Release 6.12 of the SAS System. Any SAS data set (SAS data file or SAS data view) can be used as input for APPEND processing. APPEND is optional and can be specified only in the PROC DBLOAD step.

The APPEND option assumes that the table that is specified in the TABLE= statement exists. To create a CA-OpenIngres table to append to, first use PROC DBLOAD with the SQL statement. Then specify another PROC DBLOAD step with APPEND. If the table does not exist, the procedure fails and an error message is displayed.

Other PROC DBLOAD statements such as DELETE and RENAME work differently when they are used with the APPEND option.

Suppose that you have a data set named INVDATA that you want to append to an existing CA-OpenIngres table. The following example shows how to use the APPEND option to append rows from the INVDATA data set to the table named INVOICE.

```sas
proc dbload dbms=ingres data=invdata append;
  database='testnode::testdatabase/star';
  table=invoice; load;
run;
```

PROC DBLOAD Statements

DATABASE='<v-node::database <server-type>>';

indicates the name of the database where you want to store the new table. You must enclose it in single or double quotes. This statement is required. If you
specify a database, it must exist. If you do not know the names of your databases, contact your DBA.

If you use a remote database, you enter the remote virtual node name. If you use a distributed database, you enter the database server type. If you use a remote distributed database, you enter the database node name and server type.

v-node

is the name of the remote virtual node where the database is located. It implies that the network node address and protocol have been defined by the NETU utility that is provided by CA-OpenIngres. If you are accessing a local database, you do not need to enter the virtual node name. For more information about the NETU utility, refer to your CA-OpenIngres/Net user’s and administrator’s guide.

database

is the name of the database.

server-type

is the type of server that is being accessed at the local or remote site. Valid server types are INGRES for a CA-OpenIngres DBMS server or STAR for a CA-OpenIngres/Star server. (You can replace /STAR with its alias, /D.) If you omit a server type, the default server type, INGRES, for the CA-OpenIngres DBMS is used.

The following example creates a new CA-OpenIngres table, INVOICE, from the DLIB.INVOICE data file. An access descriptor ADLIB.INVOICE is also created, based on the new table. The AMTBILLED column and the 5th column in the table (AMOUNTINDOLLS) are renamed. You must be granted the appropriate privileges in order to create new CA-OpenIngres tables or views.

```
libname adlib 'SAS-data-library';
libname dlib 'SAS-data-library';

proc dbload dbms=ingres data=dlib.invoice;
  database='testdatabase'; table=invoice;
  accdesc=adlib.invoice;
  rename amtbilled = amountbilled
                5 = amountindollars;
  nulls invnum=n amtbill=n;
  load;
run;
```

The next example only sends an SQL GRANT statement to the TESTDATABASE database and does not create a new table. Therefore, the TABLE= and LOAD statements are omitted.

```
proc dbload dbms=ingres;
  database='testdatabase';
sql grant select on customers to testuser;
run;
```
Statement Interactions with the APPEND Option

DELETE and RENAME
DELETE and RENAME enable you to perform one-to-one matching of SAS variables to CA-OpenIngres columns. When you use the APPEND option, there must be a CA-OpenIngres column for every SAS variable that you are loading.

Use the DELETE statement to drop a SAS input variable that has no corresponding CA-OpenIngres column. Use the RENAME statement if the names do not match. If there is not a CA-OpenIngres column for each SAS variable, the APPEND operation is rejected.

The RENAME statement indicates the column name in the CA-OpenIngres table for the SAS data set variable that you specify. This example loads the data that is associated with the SAS variable COUNTRY into the CA-OpenIngres column named ORIGIN.

```
rename country=origin;
```

ERRLIMIT=
The DBLOAD ERRLIMIT= statement has a default of 10 when the APPEND option is specified, instead of the default of 100.

LOAD
The LOAD statement is required.

NULLS
The NULLS statement has no effect when the APPEND option is specified, unless the table is created in the same step.

TYPE
The TYPE statement has no effect because the input SAS variable types and the CA-OpenIngres column types must have a one-to-one match.

SQL Procedure Pass-Through Facility: CA-OpenIngres Specifics

The following section describes the DBMS-specific arguments that you use in the CONNECT statement in order to establish a connection with a CA-OpenIngres database.

Arguments to Connect to CA-OpenIngres
CA-OpenIngres has one database-connection-argument that you can specify in this statement. It can also be used to connect to multiple databases.

```
CONNECT TO INGRES <AS alias> (DATABASE='v-node::database-name'/server-type);
```

(DATABASE='v-node::database-name'/server-type)

is where you specify the name of the CA-OpenIngres database. You must enter a value in this field and enclose the entire option in parentheses.
If you use a remote database, you enter the remote virtual node name. If you use a distributed database, you enter the database server type. If you use a remote distributed database, you enter the remote virtual node name and server type. The arguments for the DATABASE= field are:

- **v-node** is the name of the remote virtual node where the database is located. It implies that the network node address and protocol have been defined by the NETU utility that is provided by CA-OpenIngres. For more information on the NETU utility, refer to your CA-OpenIngres/Net user's and administrator's guide.

- **database-name** is the name of the database.

- **server-type** is the type of server that is being accessed at the local or remote site. Valid server types are **INGRES** for a CA-OpenIngres DBMS server or **STAR** for the CA-OpenIngres/Star server. (You can replace /STAR with its alias, /D.) If you omit a server type, the default server type, INGRES, for the CA-OpenIngres DBMS is used.

The following example connects to CA-OpenIngres by using the alias ING1 and sends an EXECUTE statement. The distributed database name is TESTDATABASE, and it is located on a virtual node that is named TESTNODE. The alias D is used to specify the STAR server.

```sql
proc sql;
  connect to ingres as ing1
    (database='testnode::testdatabase/d');
  execute (create view whotookorders as
      select ordernum, takenby,
         firstname, lastname, phone
      from orders, employees
      where
        orders.takenby=employees.empid)
    by ing1;
  execute (grant select on whotookorders
           to testuser) by ing1;
  disconnect from ing1;
quit;
```

The following example connects to the TESTDATABASE database and performs a query, shown in italics, on the CUSTOMERS table:

```sql
proc sql;
  connect to ingres (database=testdatabase);
  select *
    from connection to ingres
     (select * from customers
      where customer like '1%');
  disconnect from ingres;
quit;
```
CA-OpenIngres Naming Conventions

CA-OpenIngres database objects that can be named include tables, views, columns, indexes, and database procedures. Use the following CA-OpenIngres naming conventions:

- A database name cannot begin with an underscore.
- A name starts with a letter or an underscore. Names cannot begin with numbers or special characters such as #, @, $.
- A name can be from 1 to 24 characters long. Objects that are managed by the CA-OpenIngres user interfaces (QBF, RBF, ABF, and Vifred) can be up to 32 characters.
- A name can contain the letters A through Z, the digits 0 through 9, the underscore (_), the dollar sign ($), the pound sign (#), and the at sign (@). (Although dollar signs are permitted in names, they are also used in some operating system-supplied names. To avoid conflicts with these names, it is recommended that you not use dollar signs in your table, view, column, or index names.)
- Case significance is determined by the setting with which the database is created: CA-OpenIngres or ANSI/ISO Entry SQL-92–compliant. The default for CA-OpenIngres is lowercase, and the default for ANSI/ISO Entry SQL-92–compliant is uppercase.
- A table name cannot begin with ii or sq, which are reserved table names for use by CA-OpenIngres.
- A name may not be the same as another CA-OpenIngres database object that has the same type.

CA-OpenIngres SQL Data Types

Every column in a table has a name and a data type. The data type tells CA-OpenIngres how much physical storage to set aside for the column and the form in which the data is stored.

Character Data

The character data types for CA-OpenIngres SQL are listed below, where n is the length of the character string.

- **CHAR(n)**, **C_{n}
  
is the fixed-length character string where n represents a string of 1 to 2000 ASCII characters. CHAR is preferred over C. CHAR can contain any printing or nonprinting characters and the NULL character. When comparing CHAR strings, blanks are significant.

  For compatibility with previous versions of CA-OpenIngres, C is supported. C can contain only printing characters; nonprinting characters are converted to blanks. When comparing C strings, blanks are ignored.

  **VARCHAR(n)**, **TEXT(n)
  
is the varying-length character string where n represents a string of 1 to 2000 ASCII characters. VARCHAR is preferred over TEXT. VARCHAR can contain any
printing and nonprinting characters and the NULL character. When comparing VARCHAR strings, blanks are significant. VARCHAR, when comparing strings of unequal length, adds blanks to the end of the shorter string to make it the same length as the longer string.

TEXT can contain all ASCII characters except NULL characters, which are converted to blanks. When comparing TEXT strings, blanks are significant. TEXT, when comparing strings of unequal length, considers a shorter string "less than" a longer string if all characters up to the length of the shorter string are equal.

LONG VARCHAR

is the varying-length column for character string data. A LONG VARCHAR string can be up to two gigabytes in length. SAS/ACCESS does not currently allow you to use data in CA-OpenIngres LONG VARCHAR columns.

TEXT

is the varying-length character string that can contain all ASCII characters except NULL characters. NULL characters are converted to blanks. When comparing TEXT strings, blanks are significant. TEXT, when comparing strings of unequal length, considers a shorter string "less than" a longer string if all characters up to the length of the shorter string are equal. TEXT is supported for compatibility with previous versions of CA-OpenIngres.

**Numeric Data**

The numeric data types for CA-OpenIngres SQL are listed below.

REAL, FLOAT4, DOUBLE PRECISION, FLOAT, FLOAT8

Floating-point values consist of the following: an integer part, a decimal point, and a fraction part or scientific notation of the format that follows:

\[+\)\[\-\]digit \[.]\[\-\]digit \[e\)\[\-\]digit \[+]\[\-\]digit \]

where the clauses that are enclosed in the angle brackets (<>) are optional and, if used, can be repeated. The FLOAT4 (4 byte) range is \(-1.0e+38\) to \(+1.0e+38\) with 7-digit precision. The FLOAT (8 byte) range is \(-1.0e+38\) to \(+1.0e+38\) with 16-digit precision.

The default character that indicates the decimal point is a period (.). This character can be changed by setting II_DECIMAL. For more information on setting II_DECIMAL, refer to your CA-OpenIngres installation and operations guide.

Note: REAL is a synonym for FLOAT4. FLOAT8 and DOUBLE PRECISION are synonyms for FLOAT.

SMALLINT, INTEGER2, INTEGER1, INTEGER, INTEGER4

Integers contain no fractional part. The three integer data types are INTEGER1 (1 byte), which has a range of \(-128\) to \(+127\), SMALLINT (2 byte), which has a range of \(-32,768\) to \(+32,767\), and INTEGER (4 byte), which has a range of \(-2,147,483,648\) to \(+2,147,483,647\).
Note: INTEGER2 is a synonym for SMALLINT. INTEGER4 is a synonym for INTEGER.

DECIMAL | DEC | NUMERIC

exact numeric data type defined in terms of its precision (total number of digits) and scale (number of digits to the right of the decimal point). The minimum precision for a decimal value is 1 and the maximum is 31. The scale of a decimal value cannot exceed its precision. Scale can be 0 (no digits to the right of the decimal point).

Abstract Data

CA-OpenIngres SQL date and money data types are abstract data types.

DATE

Dates are input as quoted character strings. CA-OpenIngres accepts U.S. date input formats, absolute time input formats, and combined date and time input formats. DATE (12 bytes) has a range of 1-JAN-1582 to 31-DEC-2382 (for absolute dates) and -800 years to 800 years (for time intervals).

CA-OpenIngres assumes that the year is the current year if the year is omitted. If a two-digit year is used in formats with delimiters such as forward slashes (/) or dashes (–), or if the year is omitted from the date, CA-OpenIngres assumes that the century is 1900.

CA-OpenIngres assumes the current (today's) date if the date is omitted from an absolute time entry.

Dates are stored in Greenwich Mean Time (GMT). The SAS/ACCESS interface to CA-OpenIngres takes care of converting dates. In the following tables, xxx represents a time zone designation. Valid time zone designations are edt, cdt, mdt, pdt, gmt, est, cst, mst, and pst. CA-OpenIngres assumes the local time zone if a time zone designation is not supplied.

At this time, the SAS/ACCESS interface to CA-OpenIngres does not support the CA-OpenIngres date and time interval formats.

The default date output format for CA-OpenIngres is U.S. You can change this format by setting II_DATE_FORMAT. For more information about II_DATE_FORMAT, refer to your CA-OpenIngres SQL reference manual and your CA-OpenIngres installation and operations guide.

For information about changing the date format conventions to accommodate international conventions, refer to your CA-OpenIngres SQL reference manual.

Table 15.1 U.S. Input Formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>'mm/dd/yyyy'</td>
<td>'05/16/1991'</td>
</tr>
<tr>
<td>'dd-mmm-yyyy'</td>
<td>'16-may-1991'</td>
</tr>
<tr>
<td>'mm-dd-yyyy'</td>
<td>'05-16-1991'</td>
</tr>
<tr>
<td>'yyyy-mm-dd'</td>
<td>'1991-05-16'</td>
</tr>
</tbody>
</table>
Table 15.2 Absolute Time Input Formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>'mmddyy'</td>
<td>'051691'</td>
</tr>
<tr>
<td>'mm/dd'</td>
<td>'05/16'</td>
</tr>
<tr>
<td>'mm-dd'</td>
<td>'05-16'</td>
</tr>
<tr>
<td>'today'</td>
<td>The string 'today' has today's date as its value.</td>
</tr>
<tr>
<td>'now'</td>
<td>The string 'now' has the current date and time as its value</td>
</tr>
</tbody>
</table>

Table 15.3 Combined Date and Time Input Formats

<table>
<thead>
<tr>
<th>Format</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>'hh:mm:ss'</td>
<td>'10:30:00'</td>
</tr>
<tr>
<td>'hh:mm:ss xxx'</td>
<td>'10:30:00 est'</td>
</tr>
<tr>
<td>'hh:mm:ss [am</td>
<td>pm] xxx'</td>
</tr>
<tr>
<td>'hh:mm'</td>
<td>'10:30'</td>
</tr>
<tr>
<td>'hh:mm xxx'</td>
<td>'10:30 est'</td>
</tr>
</tbody>
</table>

MONEY

Money values in CA-OpenIngres are stored as their actual money amount. Money values are significant to exactly two decimal places, and on input and output their amounts are rounded in dollars and cents. Arithmetic operations on MONEY retain the precision of two decimal places. MONEY (8 byte) has a range of $-999,999,999.99 to $999,999,999.99.

Money values in CA-OpenIngres are displayed as 20-character strings. The display format is $sdddddddddddd.dd where s is the sign (− for negative and no sign for positive), and d is a digit from 0 to 9.
CA-OpenIngres accepts money values on input as character strings, numbers, valid integers, or floating-point numbers.

For information about the logical names that affect the display of MONEY values, refer to your CA-OpenIngres installation and operations guide.

**CA-OpenIngres NULL and Default Values**

CA-OpenIngres has a special value that is called NULL. NULL means an absence of information and is analogous to the SAS System's missing value.

Columns can be defined as NOT NULL so that they cannot contain NULL data. NOT NULL tells CA-OpenIngres not to add a row to the table unless the row has a value for the column.

Columns can be defined so that they cannot contain NULL data. For example, the CREATE TABLE statement for the CUSTOMERS table in Appendix 1 defines the first column, CUSTOMER, as CHAR(8) and NOT NULL. NOT NULL tells CA-OpenIngres not to add a row to the table unless the row has a value for CUSTOMER.

**LIBNAME Statement Data Conversions**

The following table shows the default SAS System variable formats that the LIBNAME statement assigns to CA-OpenIngres data types during input operations.

<table>
<thead>
<tr>
<th>INGRES Data Type</th>
<th>Default SAS Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAR(n) or Cn</td>
<td>$n. (n &lt; 200) $200. (n &gt;= 200)</td>
</tr>
<tr>
<td>VARCHAR(n) or TEXT(n)</td>
<td>$n. (n &lt; 200) $200. (n &gt;= 200)</td>
</tr>
<tr>
<td>INTEGER1</td>
<td>4.0</td>
</tr>
<tr>
<td>SMALLINT (INTEGER2)</td>
<td>6.0</td>
</tr>
<tr>
<td>INTEGER (INTEGER4)</td>
<td>11.0</td>
</tr>
<tr>
<td>FLOAT4 (REAL)</td>
<td>none</td>
</tr>
<tr>
<td>FLOAT (FLOAT8)</td>
<td>none</td>
</tr>
<tr>
<td>DATE</td>
<td>DATETIME21</td>
</tr>
<tr>
<td>MONEY</td>
<td>DOLLAR19.2</td>
</tr>
<tr>
<td>DATE INTERVAL</td>
<td>NOT SUPPORTED</td>
</tr>
<tr>
<td>TIME INTERVAL</td>
<td>NOT SUPPORTED</td>
</tr>
<tr>
<td>DECIMAL</td>
<td>m.n (m &lt;= 31 and n &lt;= m)</td>
</tr>
</tbody>
</table>

The following table shows the default CA-OpenIngres data types that the LIBNAME statement assigns to SAS variable formats during output operations.
Table 15.5  LIBNAME Statement: Default CA-OpenIngres Data Types for SAS Variable Formats

<table>
<thead>
<tr>
<th>SAS Variable Format</th>
<th>CA-OpenIngres Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>$w</td>
<td>CHAR(n)</td>
</tr>
<tr>
<td>any date format</td>
<td>DATE</td>
</tr>
<tr>
<td>w</td>
<td>INTEGER1</td>
</tr>
<tr>
<td>.0 (w&lt;=2)</td>
<td>SMALLINT</td>
</tr>
<tr>
<td>w</td>
<td>INTEGER</td>
</tr>
<tr>
<td>.0 (w&gt;2 and w&lt;=4)</td>
<td>INTEGER</td>
</tr>
<tr>
<td>IBw.d, PIBw.d</td>
<td>INTEGER</td>
</tr>
<tr>
<td>all other numeric datatypes</td>
<td>FLOAT</td>
</tr>
<tr>
<td>DOLLAR</td>
<td>MONEY</td>
</tr>
</tbody>
</table>

ACCESS Procedure Data Conversions

The following table lists the default SAS System variable formats that the ACCESS procedure assigns to each CA-OpenIngres data type.

Table 15.6  PROC ACCESS: Default SAS Formats for CA-OpenIngres Data Types

<table>
<thead>
<tr>
<th>INGRES Data Type</th>
<th>SAS Variable Format</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHAR(n) or Cn</td>
<td>$n. (n &lt; 200) $200. (n &gt;= 200)</td>
</tr>
<tr>
<td>VARCHAR(n) or TEXT(n)</td>
<td>$n. (n &lt; 200) $200. (n &gt;= 200)</td>
</tr>
<tr>
<td>INTEGER1</td>
<td>4.0</td>
</tr>
<tr>
<td>SMALLINT (INTEGER2)</td>
<td>6.0</td>
</tr>
<tr>
<td>INTEGER (INTEGER4)</td>
<td>11.0</td>
</tr>
<tr>
<td>FLOAT4 (REAL)</td>
<td>E14.0</td>
</tr>
<tr>
<td>FLOAT (FLOAT8)</td>
<td>E23.0</td>
</tr>
<tr>
<td>DATE</td>
<td>DATETIME21.</td>
</tr>
<tr>
<td>MONEY</td>
<td>DOLLAR19.2</td>
</tr>
</tbody>
</table>
DBLOAD Procedure Data Conversions

The following table lists the default CA-OpenIngres data type that the DBLOAD procedure assigns to each SAS variable format.

Table 15.7 PROC DBLOAD: Default CA-OpenIngres Data Type for SAS Variable Formats

<table>
<thead>
<tr>
<th>SAS Variable Format</th>
<th>INGRES Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>w.0</td>
<td>INTEGER1</td>
</tr>
<tr>
<td>w.0</td>
<td>SMALLINT</td>
</tr>
<tr>
<td>w.0</td>
<td>INTEGER</td>
</tr>
<tr>
<td>IBw.d, PIBw.d</td>
<td>INTEGER</td>
</tr>
<tr>
<td>all other numeric data types</td>
<td>FLOAT</td>
</tr>
<tr>
<td>DOLLAR</td>
<td>MONEY</td>
</tr>
<tr>
<td>any SAS date, datetime, or time format</td>
<td>DATE</td>
</tr>
<tr>
<td>$n</td>
<td>CHAR(n)</td>
</tr>
</tbody>
</table>

Distributed CA-OpenIngres

The following products are used in the CA-OpenIngres distributed relational database management system to enable you to simultaneously access multiple CA-OpenIngres and non-CA-OpenIngres databases on local and remote servers.

CA-OpenIngres

is the CA-OpenIngres relational database management system.

CA-OpenIngres/Net

enables you to access CA-OpenIngres data on a remote server from your local computer through a link that uses an existing network.

CA-OpenIngres Gateways

enables you to access non-CA-OpenIngres data in other database servers and file management systems.

CA-OpenIngres /Star

enables you to access multiple local, remote, CA-OpenIngres, and non-CA-OpenIngres database servers at the same time.

To access the various databases of distributed CA-OpenIngres through SAS/ACCESS to CA-OpenIngres, you indicate, as appropriate, the virtual node name, the database...
Controlling Locks

Locks are completely under the control of CA-OpenIngres. The interface view engine, ACCESS procedure, and DBLOAD procedure all obtain locks of varying types on CA-OpenIngres tables and views.

Read Only Locks

When the interface view engine reads data from a CA-OpenIngres table or view, an SQL SELECT statement is issued to place a shared lock on the table. (A shared lock enables more than one user to access the data.) This lock is active for the entire execution of the procedure, regardless of the number of passes through the data the procedure requires. For example, the PRINT procedure places a shared lock on the table, and the lock remains active until all the specified data have been written to the Output window (that is, displayed).

UPDATE Locks

When you use the DATA step or certain procedures (such as FSEDIT or SQL) to update CA-OpenIngres data, an exclusive lock is placed on the CA-OpenIngres data. (An exclusive lock enables only a single user to access the data.) Except in the case of the DBLOAD procedure, these locks remain active only for the duration of a specific update and not for the entire procedure.

For example, in the FSEDIT procedure, if you update, delete, or add an observation, the interface starts an exclusive lock. That lock remains active until you complete your update, delete, or add.

Note: At every update, it is possible that a particular update process (for example, a PROC FSEDIT DATA=... statement) is not executed immediately. This indicates that another user has that CA-OpenIngres table locked. Your process remains in a "wait" state until the lock is released. If the "wait" is too long and times out, an error message is written to the SAS log.

When a table is to be loaded, the DBLOAD procedure issues a CREATE table statement, which causes an exclusive lock to be placed on the table. This lock is active until a commit is issued. (If the table already exists, an error message is written to the SAS log and the new table is not created.)

When you use a PROC DBLOAD SQL statement or the Query Entry window to submit SQL statements to CA-OpenIngres, locks are obtained in the same way as if you had issued the SQL command from the CA-OpenIngres Interactive SQL utility (called the CA-OpenIngres terminal monitor).

The following table shows examples of the locks CA-OpenIngres issues for some of the SAS/FSP interactive windowing procedures.
Table 15.8  CA-OpenIngres Locks for Interactive SAS/FSP Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Lock Level</th>
<th>Lock</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSEDIT</td>
<td>Table</td>
<td>IX (intended exclusive)</td>
</tr>
<tr>
<td>Page lock(s) on pages in table</td>
<td>X (exclusive or write)</td>
<td></td>
</tr>
<tr>
<td>FSBROWSE</td>
<td>Table</td>
<td>IS (intended shared)</td>
</tr>
<tr>
<td>Page lock(s) on pages in table</td>
<td>S (shared or read)</td>
<td></td>
</tr>
<tr>
<td>FSVIEW</td>
<td></td>
<td></td>
</tr>
<tr>
<td>□ for browsing</td>
<td>Table</td>
<td>IS (intended shared)</td>
</tr>
<tr>
<td>Page lock(s) on pages in table</td>
<td>S (shared or read)</td>
<td></td>
</tr>
<tr>
<td>□ for editing</td>
<td>Table</td>
<td>IX (intended exclusive)</td>
</tr>
<tr>
<td>Page lock(s) on pages in table</td>
<td>X (exclusive or write)</td>
<td></td>
</tr>
</tbody>
</table>

To prevent users from being locked out of the data, you should encourage SAS/FSP software users to browse CA-OpenIngres data if they do not intend to change the data. You might also want to restrict who can use these procedures to access CA-OpenIngres data. For more information about locks, refer to your CA-OpenIngres database administrator’s guide.